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KURU: CLINICAL STUDY OF A NEW SYNDROME RESEMBLING PARALYSIS AGITANS IN NATIVES OF THE EASTERN HIGHLANDS OF AUSTRALIAN NEW GUINEA.

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Port Moresby.

IN a mountain-dissected region of the Eastern Highlands of the Australian Trust Territory of New Guinea, a disease syndrome new to western medicine, clinically akin to *paralysis agitans* or Parkinsonism, and apparently belonging to the group of chronic progressive heredofamilial degenerative disorders of the central nervous system, has been observed in an extraordinarily high incidence among the Fore people and their immediate tribal neighbours. The current report is concerned with the clinical, pathological and epidemiological description of this newly discovered disease, over 150 cases of which the writers have had the opportunity of observing during the investigations which are herein reported (Gajdusek and Zigas, 1957). Some 80 cases of the disease, which is designated "kuru" by the natives, have been intensively studied in a Kuru Research Centre which we established at the Okapa Patrol Post in the Fore Linguistic and Cultural Area, with the kind cooperation and assistance of Patrol Officer Jack Baker and the Government of the Australian Trust Territories. The accompanying map (Figure I) illustrates the location of the Okapa Patrol Post, the centre of the kuru region in the Eastern Highlands of New Guinea.

Historical Background.

About five years ago the region south and east of Mount Michael (elevation 12,500 feet) in the southern portion of the Eastern Highlands of the Australian Trust Territory of New Guinea was pacified by a series of contact patrols through the native villages of three linguistic groups, the Fore, the Keiagana and the Kimi. Intertribal and intervillage warfare, ritual killings, sorcery and cannibalism, which included the eating of all those who died, were discouraged; but even at present remnants of these practices survive. The first recorded Caucasian contact received by the Fore people was the expedition in 1932 of Ted Eubanks, a gold prospector. A Lutheran Mission was set up in 1949 at Tarabo in the Keiagana Linguistic Area, and the Tarabo region was selected as the site for the first Government Patrol Post in the region, which was established by Patrol Officer J. R. MacArthur in 1952. In the diary of his patrol report on the opening

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[2] Aided by a grant from the National Foundation for Infantile Paralysis.

of the new area south of Mount Michael, Mr. J. R. MacArthur reported as follows on Sunday, December 6, 1953:

> Proceeding SW across range, and down and across a small creek ascending to Amusi villages, nearing one of the dwellings, I observed a small girl sitting down beside a fire. She was shivering violently, and her head was jerking spasmodically from side to side. I was told that she was a victim of sorcery, and would continue this shivering unable to eat until death claimed her within a few weeks.

In 1952 and 1953 R. M. and Mrs. Berndt noted the illness among the Fore, Jate and Usurufa peoples.

Patrol Officer MacArthur continued to encounter this shaking illness, called by the Fore "kuru"—a word they also use for trembling from fear or cold—during his patrols in this area, and succeeding patrol officers found the problem of kuru to be the most important medical problem in the region. Patrol Officer J. MacArthur and others all brought this strange disease to the attention of Dr. V. Zigas, then District Medical Officer at Goroka. Since that time, Dr. Zigas has taken every opportunity at his disposal to observe cases of kuru. In October, 1956, he was able to spend a few weeks in the Okapa region, and during that time he obtained blood serum specimens from 26 subjects of kuru and the brain from one patient dead of the illness; all this material was sent to Dr. S. G. Anderson, at the Walter and Eliza Hall Institute of Medical Research in Melbourne, Australia. No infectious agent was isolated from the brain by chorio-allantoic membrane inoculation of chick embryos or by intracerebral passage in suckling and adult mice. Sera contained no neutralizing antibody to Murray Valley encephalitis virus, which, with the exception of dengue, is the only arthropod-borne encephalitic virus thus far isolated from New Guinea or Papua (French and Anderson, 1957).

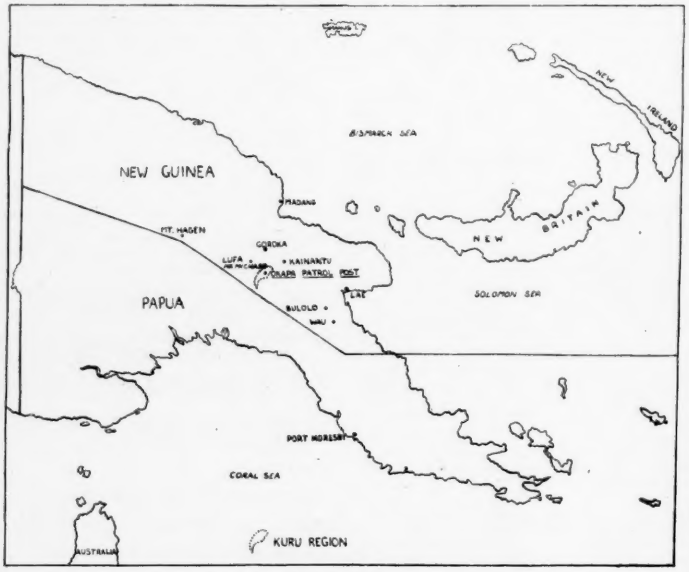

FIGURE I.

Map of New Guinea, showing kuru region.

Early in March, 1957, Dr. Gajdusek joined Dr. Zigas in New Guinea, and the two writers inaugurated an intensive study of the disease at the Okapa Patrol Post, which is the administrative centre of the area affected by kuru. A special building of native materials was quickly erected to house the kuru patients whom we assembled, and a laboratory and treatment room was built in which examinations and studies could be conducted. Jeep transport along a rough 40-mile road to Kainantu provided a means of sending specimens out to an air strip, from where they were flown for special studies to laboratories in Port Moresby, Australia and the United States. The Kuru Research Centre which was thus set up subsequently proved to be located very close to the geographic and population centre of the kuru region. Over 80 patients have been intensively studied by clinical and laboratory investigations, and therapeutic trials of numerous drugs have been conducted here. In addition, case-finding and epidemiological patrols were conducted throughout the kuru region and into the surrounding territory from this centre. On such patrols another 70 patients have been studied in their village setting.

Clinical Picture

Kuru is remarkable for the uniformity of its symptomatology and clinical course. In fact, so unvaried is the clinical pattern that its stages are described by the natives in almost unvarying form throughout the kuru-affected region, and both the disease and descriptions of its phases have become part of the traditional magic lore of the Fore people. However, in the following account the writers will emphasize the variations in the clinical picture that they have been able to observe.

The first symptom is locomotor ataxia, insidiously progressive and often noted by others before the patient himself is aware of it. About one-third of the patients report knee pains, headache, malaise, fever, cough and coryza, in order of decreasing frequency, as prodromal symptoms, but none report an acute incapacitating antecedent illness with emesis, stiff neck, convulsions, paresis, coma or even moderate interference with normal activities. Thus, antecedent acute infectious illness severe enough to be recognized as meningoencephalitis or any other diagnosable acute infectious disease is absent.

The ataxia becomes more marked, with awkward placement of of the feet and a swaying and weaving gait, and the patient tends to trip and stumble. He often describes this phase as "loose knees". As ataxia becomes progressively more severe, a distinctive tremor involving the trunk, extremities and head appears, and this tremor is exaggerated when the patient attempts coordinated voluntary motor activities or when he is excited or apprehensive, fatigued or exhausted. Within one month of the onset both the ataxia and tremors are usually prominent; but the patient generally continues a normally active life.

The tremor is usually irregular and of fine quality, of approximately two to three per second frequency, and has the appearance of shivering. It largely subsides when the patient is sitting quietly relaxed, and it disappears in sleep; but generalized tremors appear when the patient is emotionally stimulated, and they become exaggerated upon muscular activity, particularly in those muscle groups placed under controlled motor response. During the second to third month of illness, when tremors become more severe and rather coarse in quality, they may interfere with eating and with any fine motor skills involving hands or feet, and a choreiform component may enter into the involuntary motor pattern. Some patients progress to wild, somewhat athetoid involuntary movements in addition to the tremors and choreiform jerks, and this is particularly noticeable when they try to rise to an erect from a recumbent or sitting posture. By this stage the patient is no longer able to walk without the support of a stick; yet he generally continues to perform his usual daily chores about the village and gardens. However, most patients can continue to walk with such support for only

one or two months, and thereafter can no longer maintain their equilibrium unassisted. From that time the patient remains sedentary, but still moderately well integrated in his native society, sitting outside the house and half-carried to attend pig feasts or other social functions. However, he invariably rapidly deteriorates until he can no longer balance even in a sitting posture without being supported, and thereafter is carried out of the low, dark, kunai-grass houses only for urination and defæcation. In a short while, in this advanced stage of disease, reached generally in the usual village setting at from three to six months from the onset, the patient is no longer carried from the dark houses, but is left to lie indoors, with fæcal and urinary incontinence and rapidly developing decubitus ulcers. Convergent strabismus is often present at this time. Until the patient can no longer maintain a sitting posture unaided, he usually can still bring food to his mouth and eat; once he assumes decubitus he must be fed. This stage is brief, however, and the mute patient then rapidly succumbs to starvation, infected decubitus ulcers, occasional accidental burns from the house fire, and secondary static bronchopneumonia. Throughout the disease the patient remains afebrile unless an intercurrent infection develops.

Speech and intelligence are normal in the early stages of the disease, but dysarthria appears in the second to fourth month and becomes more marked as the disease progresses. At the time when the patient is no longer able to walk without extensive bilateral support, speech is usually extremely blurred and slurred; yet it is still intelligible, and verbal responses, although much slowed, reveal good orientation and are usually appropriate. Even at an advanced stage of incapacitation the mute patient, who only occasionally groans, may still respond intelligently to requests with a feeble motor response after much verbal urging.

As the disease progresses, but still in the early months of illness, marked emotionalism appears; inappropriate excessive laughter and slowly relaxed smile or paroxysmal hilarity alternate at times with moods of depression and, occasionally, of moderately belligerent and aggressive behaviour. This moodiness, more usually that of excessive euphoria than of depression, settles later into a gradual pattern of withdrawal, with a mask-like facies resembling that of classical Parkinsonism; the flexed posture is characteristic of the disease.

In the native village the disease usually runs its course in six to nine months and rarely lasts over one year. Occasional patients die within three to six months of the onset. A few cases, particularly in older women, run a more slowly progressive course to terminate fatally in one to two years or longer. Thus far, in only two of the writers' 154 cases studied has recovery occurred, and these two, like the few other recoveries that it has been possible to document, were in adult females of decidedly hysterical temperament. It is the writers' current hypothesis that the illness is uniformly fatal, and that the few recoveries that they have documented and the two that they have observed are cases of hysterical mimicry of the ataxia, dramatic involuntary tremors and incoordination of kuru. They have observed no case of recovery in a preadolescent child; nor have they obtained reports of such a case, and in no case of advanced disease has recovery occurred to their knowledge. Since the kuru pattern occupies a very significant place in current Fore culture, in which it is believed to be a purely sorcery-induced malady, all recoveries being attributed to counter-sorcery or to removal of the kuru-inducing charm, it would not be surprising to find it a pattern for occasional hysterical mimicry.

The course of the disease is usually unrelentingly progressive, with continuous and uninterrupted deterioration. However, a rare case with remissions and exacerbations has been recorded. One female child, aged six years, with early mild ataxia of kuru, recovered completely for two months, but now appears to have again developed the ataxia and tremors of early kuru. A second, moderately severe, case in a woman aged 25 years is reported to be in its third exacerbation, having completely remitted twice (once 15 to 18 months ago and a second time six months ago) for periods of several months after having progressed to the stage of such tremors and ataxia that a stick was required for walking. In the latter case the condition appears now to be rapidly advancing and it appears likely that it will soon be fatal.

In addition to these rare recoveries and remissions, the writers have found two atypical cases of kuru which are already of several years' duration, and in which the condition regularly appears and remits with the onset and termination of the patients' menstrual periods. Whether this periodic non-malignant illness and the cases of apparent recovery are examples of kuru incompletely expressed—*formes frustes* of kuru—which may offer valuable clues to its pathogenesis, or whether they are distinct nosological entities, remains an unsolved problem.

Kuru does not interfere with normal pregnancy. Many of the present series of kuru patients are pregnant, and two have delivered normal children while suffering from moderately advanced disease. The writers have recorded many cases of normal pregnancies and of deliveries of normal infants even in very advanced and incapacitating stages of the disease. Other patients have died before term without miscarrying before death.

FIGURE II.
View of the Kuru Research Centre and Hospital at the Okapa Patrol Post (elevation 6500 feet).

Physical Findings.

In early stages of kuru, physical examination reveals no systemic abnormalities other than those referable to the central nervous system. There is no fever except for that associated with inevitable occasional intercurrent infections. Nutrition is generally excellent, and there is no muscular atrophy. The cardio-vascular, respiratory, gastro-intestinal, hæmatopoietic, genito-urinary and endocrine systems are normal. Examination of the abdomen reveals no abnormality, and there is no hepatomegaly or splenomegaly. Lymphadenopathy is absent. The skin and mucosa are clear; there is no enanthem or exanthem. No heavy metal lines or pigmentation changes are seen on the gums or buccal mucosa, except for the bluish-grey plaques opposite the line of dental occlusion seen in most natives of this region. Until late in the illness there is no muscular weakness or paralysis and no rigidity or spasm, and although in advanced stages severe muscular spasm and intermittent resistance to passive motion of the extremities appear, muscular contractures are very late in developing in spite of the predominantly flexed posture which the patients generally assume, and may not develop at all.

Examination of the eyes reveals no abnormalities other than convergent strabismus, which first appears late in the illness. When severe tremors are present the patient has difficulty in maintaining a fixed gaze, and his glance tends to shift about rapidly and irregularly. Nystagmus is absent, and the pupils react normally to light and to accommodation. Extraocular movements are normal. Blinking frequency is sometimes diminished. Fundoscopic examination reveals no papillœdema, exudate, hæmor-

rhages, optic atrophy, macular degeneration or other abnormality. There is no greenish-yellow pigmentation at the sclero-corneal border (Kayser-Fleischer rings).

Cranial nerve functions remain intact. No sensory disturbance has been detected in early or moderately advanced cases. In later stages of the disease it is impossible to perform an adequate sensory examination. Emotionalism and intellectual slowing have been fully discussed above.

FIGURE III.

A group of six kuru patients from the Fore village of Paiti in the southern part of the kuru region. All are females and only one is a child. These six cases occurred in a populace of only 190. The photograph was taken in June, 1957; by September four of these six patients, including the child, had died of the disease.

The pattern of deep tendon reflexes and of cutaneous reflexes remains normal, although in some patients there is a moderate hypoactive response pattern and in others the reflexes are moderately hyperactive. Occasionally an unsustained but five-to-ten-times repetitive ankle clonus is found, particularly in advanced cases of disease, but no other reflex abnormalities are seen. Rarely fully sustained ankle clonus develops. No sign of pyramidal tract damage appears, and the plantar responses are flexor in type even in the terminal stages of the illness. Slight disturbances of articulation may appear while the patient is still ambulatory; but marked dysarthria and, later, dysphasia are present in all advanced cases.

Cerebellar function tests reveal that Romberg's sign is present after the disease has progressed for a few months; but earlier we have noted that the patients first lose the ability to stand on one foot with eyes closed, and subsequently then cannot maintain balance on one foot even with their eyes open. Cerebellar function tests tend to exaggerate the irregular tremors and choreiform component in their involuntary jerks; at times even a somewhat athetoid pattern appears in the extremities of patients attempting these tests in the more advanced stages of the disease. Usually the response to the heel-shin test is more extensively disturbed than are the responses to finger-to-finger and finger-to-nose tests, and difficulty with the heel-shin test tends to appear earlier than that in the upper extremities. Adiodochokinesis is present early in kuru, and "pianoplaying" and other fine finger movements soon become very clumsy. When the Romberg test is applied, characteristic clawing and gripping movements of the toes appear as the patient strives to maintain an erect posture.

Laboratory Findings.

Laboratory examinations have thus far revealed little departure from normal. Lumbar punctures with check of the cerebro-spinal fluid (C.S.F.) dynamics and C.S.F. examinations, repeated hæmatological and urine examinations, numerous clinical chemical determinations and serological studies have been carried out on 80 of the present 154 studied kuru patients. These included 27 children aged under 15 years. Hæmatological studies have regularly included erythrocyte and leucocyte counts and differential leucocyte counts from stained thin films, hæmoglobin determinations (Sahli), estimations of the erythrocyte sedimentation rates (Westergren method). Examinations of the urine have included pH, specific gravity, sugar and albumin determinations, and microscopic examinations of urinary sediment. C.S.F. examinations included cell counts and Pandy tests, determinations of the total protein, sugar and chloride contents, and colloidal gold and Wassermann tests (both warm and icebox methods). The results of all these routine studies have, in general, remained within normal limits, with the few exceptions discussed below. In particular, no pleocytosis in the C.S.F. has been found in any case, even in subjects near death, and no elevation of the protein content of the C.S.F. has been detected. In a few cases weakly positive luetic serological findings and lues-type colloidal gold reactions have been obtained without associated C.S.F. pleocytosis or elevation of protein level. The writers have been unable to interpret these rare aberrant reactions. Patients tend to have 5% to 10% eosinophilia—occasionally 10% to 20%; but this is apparently not strikingly different from the normal Fore populace. Sedimentation rates are usually normal, although a few elevated sedimentation rates have been encountered which we could not account for by any detectable intercurrent infection, pregnancy or other cause. The results of liver function tests in several cases have been normal, as have blood urea nitrogen determinations.

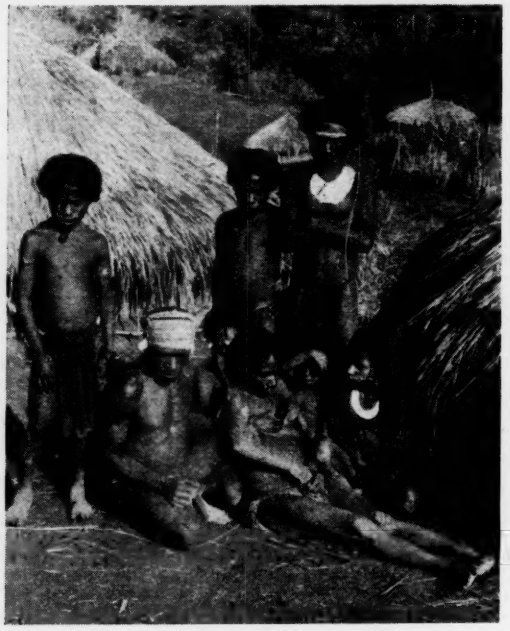

FIGURE IV.

A female victim of kuru, who has been dragged out of the native house to which she was already confined. Her husband and his second wife help support her. The others in the picture are all children of the patient. This patient died within one month after this photograph was taken.

Serum protein determinations (total serum proteins and serum albumin, total serum globulin, serum gamma globulin) have revealed unusual serum globulin patterns, which, however, are characteristic of the serum from many New Guinea Highland natives not suffering from kuru. Paper electrophoretic studies of serum and of hæmoglobins from the present patients have been performed by Dr. Cyril Curtain, of the Baker Medical Research Institute in Melbourne. Enormous elevations of beta globulin levels in many cases, and high alpha globulin levels in some have been encountered. These findings must be correlated with results obtained on normal Fore natives, and this matter

is under investigation. Paper electrophoretic study of the hæmoglobins from kuru patients has revealed no abnormal hæmoglobins.

Auto-immune complement fixation (A.I.C.F.) tests and A.I.C.F. reactions (Gajdusek, 1957) performed with the use of normal human liver, kidney and brain tissue antigens have failed to reveal any high titre positive reactions.

Blood group testing of 71 kuru patients for A–B–O, MN–S, Rh, C^w, P, Le^a, and Fy^a and K systems by R. T. Simmons, of the Commonwealth Serum Laboratories in Melbourne, has revealed a pattern similar to that reported for natives of Chimbu, Nondugl and Mt. Hagen in the Central Highlands of New Guinea (Semple *et alii*, 1956; Simmons *et alii*, 1953; Ivinskis *et alii*, 1956). Serum titres for anti-A and anti-B were all normal, and a search for atypical blood group antibodies in serum revealed none.

The serum and total blood copper levels, along with the levels of other trace metals in blood, urine, C.S.F. and tissues obtained at autopsy, are being determined in collaboration with Dr. A. V. G. Price, of the Public Health Laboratory, and Mr. Baseden and Mr. Southern, chemists of the Department of Agriculture in Port Moresby, Papua. No abnormalities have yet been discovered. In particular, blood copper levels in a number of cases have been found to be normal or slightly elevated, but no more so than such levels in control Fore subjects.

FIGURE V.

A middle-aged kuru victim arriving at the kuru hospital on a stretcher. This patient already had severe dysarthria and marked aggressive emotionalism, and she died only one month after this picture was taken.

Extensive serological surveys for neutralizing antibodies to known encephalitic viruses will later be made on the large serum file of serial serum specimens from the present patients which has been accumulated. Thus far only the studies for neutralizing antibody to the virus of Murray Valley encephalitis, performed by Dr. S. G. Anderson in Melbourne and mentioned above, have been completed; these gave negative results.

Pathological Findings.

Forty of the present 154 studied kuru patients have died during the period of our observation, and another dozen are in the terminal phases of the disease at present. The writers have been able to secure complete post-mortem examinations in eight of these, and to remove the brain only in two other cases. No gross pathological lesions were found, notably none in the brain, meninges or liver. Histological studies and neuro-histological study of the 10 fixed brains are still incomplete, and the results will be reported in a later communication. However, the preliminary pathological study of six cases reveals a widespread neuronal degeneration. The cerebellum and extrapyramidal system are most severely affected. There are also changes in the anterior horn cells, inferior olives, thalamus and pontine nuclei. There is acute destruction of the nerve cells and associated neuronophagia. The lesions are much more diffuse than those found in the slightly similar disease in Moroccan manganese miners, which in some respects resembles kuru (Rodier, 1955). Microscopic study of liver, spleen, kidney, heart, lungs, pancreas, adrenal, thyroid, pituitary, stomach, intestinal wall, bone, striated muscle and fascia, fixed in formaldehyde and in Zenker's fluid, has revealed no distinctive histological lesions.

Therapy.

Patients in all stages of illness, particularly those in the early phases, have been placed on a variety of therapeutic regimens in an attempt to determine whether any drugs could influence the course of the disease. High doses of sulphadimidine, penicillin, chloramphenicol and "Aureomycin", have been without effect. High doses of fish-liver oil, crude liver extract given parenterally, vitamin *B* complex, folic acid and many multivitamin preparations, and therapeutic doses of ferrous sulphate and ferrous gluconate have been given with no noticeable change in the patients' condition. Other drugs which have been administered in full therapeutic doses for ample clinical trials include the following: acetylsalicylic acid; calcium gluconate; the antihistamines—"Benadryl" (diphenhydramine hydrochloride) and pyribenzamine; the anticonvulsants—phenobarbital, "Dilantin Sodium" (sodium 5-5 diphenyl hydantoinate), and "Tridione" (3,5,5-trimethyloxazolidine-2,4 dione); and hormones—adrenocorticotropin, cortisone acetate, delta-1 hydrocortisone, stilbœstrol, testosterone propionate, methyl testosterone and pregnant mares' serum gonadotropin. The disease has remained unchanged or deterioration has progressed while patients have been receiving each of these. Intensive courses of B.A.L. in the form of injection of oily "Dimercaprol", similar to those regimens reported effective in hepatolenticular degeneration, have been used without demonstrable effect on the disease (Denny-Brown and Potter, 1951; Streifler and Feldman, 1953).

Differential Diagnosis.

Rare cases of recovery, which may be due to hysterical mimicry of kuru, have been discussed earlier. The usual moderately advanced case of kuru offers no diagnostic problem either to the Fore native or to the physician. In early cases no abnormality is revealed on physical examination other than slight ataxia and the mildest of tremors. The slight ataxia is often noted by the natives in daily life before the writers have been able to convince themselves of its existence, and the mild tremor of the early phases is indistinguishable from that of shivering from cold, fatigue or apprehension. Fatigue or exertion tends to bring out both tremor and ataxia and thus aids in early detection. A convenient test, it has been found, is to assess the patient's ability to stand on one foot. In a mild case, in the first month or two of the disease the patient may be able to maintain equilibrium on one foot with eyes open but not with eyes closed, while in slightly more advanced cases the patient cannot balance on one foot for more than a few seconds even with eyes open.

Clinically the disease is closely akin to Wilson's hepatolenticular degeneration; but the writers have found no liver involvement in any of their subjects, including four examined at autopsy, and greenish-yellow pigmentation is absent at the sclero-corneal border. The following must all be considered in the differential diagnosis: other heredofamilial neurological degenerations, including the cerebellar and spinal ataxias, such as hereditary spinal and cerebellar ataxia (Friedreich's ataxia), hereditary cerebellar ataxia with spasticity (Marie's ataxia), olivocerebellar and olivo-ponto-cerebellar atrophy, and parenchymatous cerebellar degeneration, and particularly heredodegenerative disorders of the *corpus striatum* involving the basal ganglia, putamen, lenticular nucleus and *globus pallidus*, which include *paralysis agitans* (Parkinsonism) and Huntington's chorea. None of these other conditions has been seen in these New Guinea natives other than a congenital tremor, of which we have seen two examples, one in a Fore man aged about 30 years and the second in a pregnant Kanite woman, aged about 35 years. These congenital tremors were more regular than those of kuru, and not associated with the profound disturbances of posture and balance or the dysarthria and emotionalism found in kuru, and, of course, they had none of the rapidly progressive degenerative character of kuru.

Sporadic cases of Parkinsonism have been observed at Chimbu, Mount Hagan, Lufa and Goroka in highland natives, but none could be confused with the rapidly progressive and fatal course of kuru.

The still mysterious, ætiologically unsolved *encephalitis lethargica* (type A encephalitis, Von Economo's encephalitis, *encephalitis epidemica*), epidemic in Europe in the decade following 1916, led to a high incidence of post-encephalitic Parkinsonism, and at times the antecedent acute encephalitis is said to have produced only very minor clinical manifestations. However, none of the many descriptions of this strange illness (now disappeared) or of the more recent sporadic alleged cases thereof are consistent with the pattern of disease seen in kuru. Furthermore, none of the specimens examined neuropathologically have shown lesions similar to those described for this illness.

Prognosis.

Kuru, as has been stated above, is usually a relentlessly and rather rapidly progressive degenerative disorder of the central nervous system, leading to total incapacitation in under one year from its onset in the majority of patients. Patients in the early stages without strabismus, slurring or blurring of speech, or complete loss of equilibrium, may have transient remissions or recover, or rarely they may have periodical remissions between menstrual periods. The problem of whether these rare cases are cases of the same disease or other syndromes has been discussed above. Once the patient is no longer able to walk, death in under a year seems inevitable, and no form of therapy which has been used has influenced the outcome.

Geographical Location.

Kuru has been observed only in a region south and east of Mount Michael in the Eastern Highlands of the Australian Trust Territory of New Guinea, exclusively in the region administered from the Okapa Patrol Post 30 miles south-west of Kainantu (see map, Figure I). All cases have occurred in this division of the Kainantu sub-district of the Eastern Highlands, and nowhere in Papua or New Guinea where continuous medical observation of native populaces has been in progress for over 20 years (*i.e.*, in such places as Port Moresby, Lae, Medang, Bulola, Wau, Goroka and Mount Hagan) has a verified case of this disease been seen. Within the Okapa region the disease is clearly one of the Fore people. Every Fore village and hamlet has a history of recent kuru deaths, and very few are lacking a currently active case of kuru in the present kuru study series. The disease thus occurs in the entire region inhabited by the Fore cultural and linguistic group and extends into the neighbouring linguistic and cultural groups of the Kimi, Auiana, Usurufa, Kanite and Keiagana peoples. Furthermore, a small group of 700 people in the Iagaria linguistic group, whose tribal lands are on the western slopes of Mount Michael, but who migrated to this region east of Mount Michael several generations ago and have extensively intermarried with the Fore into whose territory they moved, are also affected with kuru. In each of these Fore-neighbouring groups, kuru affects only that portion of the population immediately adjacent to the Fore, and more remote settlements of these other peoples, who do not intermarry with the Fore, have not experienced kuru. All the Fore neighbours are thus far known to have kuru in those settlements bordering on the Fore, except for the Kukukuku people to the south and east, who have no marriage contacts with the Fore, and who are separated from them by the formidable barrier of the Lamari River. Ecologically, however, the Lamari forms no discontinuity and variations in terrain, elevation, vegetation and rainfall are greater within the Fore lands themselves than at any of the boundaries between kuru and non-kuru peoples.

Epidemiology.

The total population of all the villages and hamlets afflicted with kuru is about 16,000, some 11,000 of whom are the Fore people themselves. In this region the writers have found and studied 154 active cases of kuru since the inauguration of their kuru research project on March 14, 1957. Of these patients, 40 have already died of kuru. Another dozen cases are near-terminal. The writers have by no means found every case in the region, although they believe that they have found most of them. They estimate that some 150 to 175 cases of kuru may currently exist in the region, and that 1% of the total population are currently afflicted with the disease and can be expected to die from it during the coming year. This is a conservative estimate, since in that portion of the affected population which the writers have fully surveyed—over two-thirds of it—somewhat over 1% of the people are currently afflicted with kuru. In certain Fore clans and tribes the current incidence of kuru reaches 5% to 10% of the population, and over 50% of all deaths in some of these communities over the past five years have been from kuru.

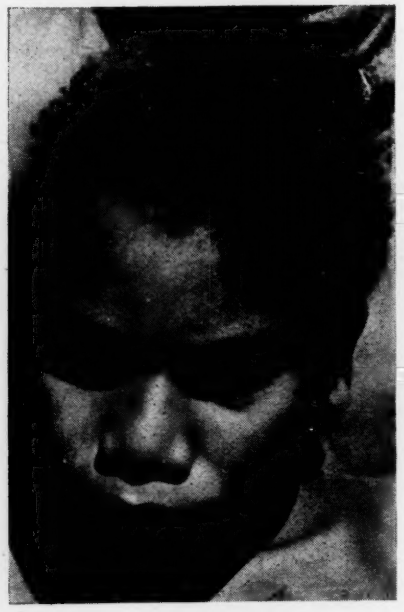

FIGURE VI.
An early pubertal boy suffering from advanced kuru, who shows marked strabismus.

The disease is so strikingly clear and so dramatic in its symptomatology and course that valid histories of kuru deaths in the past can easily be obtained. Interrogation of native informants, whose reports are vertified by independent cross-checking, reveals that kuru has been present for at least 20 years. A few well-verified cases occurred 20 to 25 years ago. Old informants usually add that the illness was not present in their youth; but there is no way of assessing the reliability of such affirmations, and we question strongly the validity of this contention. Until the current decade, very little attempt to establish government control was exerted, and until this year only one or two Caucasians have been resident in the entire region at one time. In most clans in the region the first census was taken by government census patrols between 1951 and 1956. From notes in village books over the past one to six years it is thus possible to verify a great many of the reported kuru deaths. In most clans kuru deaths are recalled before the first census patrol appeared. Thus kuru cannot be associated with the entry of Europeans into the region. However, intertribal trade routes may have introduced certain new crops and occasional manufactured items before the entry of Europeans.

Age and Sex Incidence.

Kuru is predominantly a disease of women. The age and sex distribution of the 154 cases studied since March 14, 1957, is summarized in Table I. It will be noted that 23% (*i.e.*, 36) of the 154 cases have occurred in children aged under 15 years, the remainder in older patients. The youngest patient is a boy, aged four or five years, and the writers have recorded no history of a case of kuru in a child under this age. Of the 36 cases in children, 29 occurred in children aged under 10 years, while only seven were in children whose age was estimated at 10 to 14 years. Except in the 15 to 19 years group, there is a marked female predominance; but among adults, who comprise three-quarters of the patients, there is a dramatic preponderance of females, with a male to female ratio of 1:5·6 among patients aged 20 to 29 years, and with only one case of kuru in a man out of 67 cases in subjects

TABLE I.
Age and Sex Distribution of Kuru Patients.

Age and Group. (Years.)	Number of Patients.	Total, Both Sexes.	Ratio Male to Female.
5 to 9: Male .. .. Female	8 / 21	29	1: 2·6
10 to 14: Male .. .. Female	3 / 4	7	1: 1·3
15 to 19: Male .. .. Female	7 / 6	13	1: 0·9
20 to 29: Male .. .. Female	5 / 28	33	1: 5·6
30 to 39: Male .. .. Female	1 / 48	49	1: 48·0
Over 40: Male .. .. Female	0 / 23	23	—
All ages: Male .. .. Female	23 / 130	154	1: 5·42

whose age is estimated at 30 years or over. Since over three-quarters of the cases are in adults, the full impact of the disease is upon the young adult and middle-aged woman, and it is evident that kuru has been a major factor in producing the current male preponderance in the Fore population. One might speculate that the Fore pattern of early child marriage for girls (boys do not marry early) had been at least to some extent determined by the vulnerability to kuru of the child-bearing populace.

Ætiology.

The writers have been unable to elicit any consistent history of mild or severe antecedent illness which might be interpreted as an acute infectious disease. No seasonal variation in time either of onset or of death of kuru patients has been detected. Among the Fore and their neighbours there is no tradition or memory of any epidemic of encephalitic disease. Throughout the period of kuru investigation, a regional hospital serving the 30,000 people covered by census from the Okapa Patrol Post has been supervised. During this period the writers have observed epidemic pertussis, measles, chicken-pox, epidemic parotitis, epidemic upper respiratory tract infection, epidemic bronchopneumonia of infants and young children, and epidemic gastro-enteritis of infants (the three last-mentioned conditions of undetermined ætiology). They have encountered seven cases of acute bacterial meningitis (with identification of *Neisseria meningitidis* in four, of *Diplococcus pneumoniæ* in one, and of *Hæmophilus influenzæ* in two).

Furthermore, during the past four months the writers have seen five patients with benign aseptic meningo-encephalitis with transient C.S.F. pleocytosis of from 180 to 1200 cells per cubic millimetre, 80% to 100% of the cells being mononuclear. Such patients have been carefully studied. All but one were children; this was a young adult female. The illness has more closely resembled benign aseptic (lymphocytic or mononuclear) meningo-encephalitis than acute encephalitis, for there have been no ocular symptoms and no somnolence, coma, convulsions, pareses or paralyses, and regularly fever, malaise, irritability, severe anorexia, headache and posterior neck pain and stiffness have been present. All have recovered, although convalescence has been slow, and the patients have been ill for over one month before they could resume normal activity. In two instances two patients from the same village have simultaneously been ill with this syndrome.

FIGURE VII.
A prepubertal boy suffering from advanced kuru, who survived for four months longer. At the time when the picture was taken he had moderate strabismus and could no longer maintain a sitting posture without support.

The ætiology of these cases of meningo-encephalitis remains undetermined. They have not been associated with cases of mumps in the village. No virus has been isolated from specimens of C.S.F. and of blood taken from three patients in the acute stage and sent to Australia under refrigeration for animal and chick embryo inoculation. Acute and convalescent serum pairs have been collected from these five patients for examination for antibodies to those viruses and leptospiræ known to produce this syndrome in man. Mumps has in this way been ruled out, but other results are not yet available.

None of the kuru patients present a history of a similar illness antecedent to their kuru, and these five patients with meningo-encephalitis have now recovered without

sequelæ. When these patients were shown to kinsmen of several kuru patients and to kuru patients themselves, they all denied that a similar illness had preceded the kuru in the recent or remote past. Leprosy and yaws are less frequent here than in many surrounding populaces who do not suffer from kuru, and malaria is rare. Thus the writers have observed no infectious disease which could readily be suspected as a possible regular antecedent to kuru, although many new cases of kuru have been constantly developing during their period of intense medical surveillance of the kuru region. Furthermore, although approximately one-third of kuru patients do report some headache and knee pains, and occasionally fever, cough and coryza, antecedent to the insidiously appearing ataxia (the first sign of kuru), the writers have not yet actually observed

FIGURE VIII.

A girl, aged about six or seven years, with more advanced kuru than in Figure I. This girl had lost her speech and had developed severe decubitus ulcers. She died a few weeks after this photograph was taken.

these symptoms in anyone who has progressed to clinical kuru. Therefore, they must reluctantly conclude that kuru is apparently not of post-infectious ætiology.

In spite of complex kinship (Berndt, 1954) and frequent child adoption, a reliable enumeration of the pregnancies of any child-bearing woman can be obtained. The Fore are polygamous, but tend to defend the marriage contract vigorously. Thus determination of paternity is probably no less certain than in many a literate community. Kuru deaths are found in the family history of well over half the present patients and in the parents or siblings of 46% of the 154 patients in the study. In addition, certain families possess a dramatic history of kuru, several siblings—children of a mother who died of kuru—developing the illness at different times, but each at approximately the same age. Furthermore, there are many instances of the so-called law of anticipation, the children of an affected parent developing the illness at an earlier age than the parent, although at a different time. However, in only one instance in the present series have a mother and child been ill simultaneously.

Villages and hamlets in the kuru region range in population from a few dozen to several hundred inhabitants, the smaller hamlets predominating. Marriages within a single small group of hamlets have been the rule, and marriage with close kinsmen has been preferred (Berndt, 1954). Thus it would be difficult to find "control" families in the centre of the kuru region without a high incidence

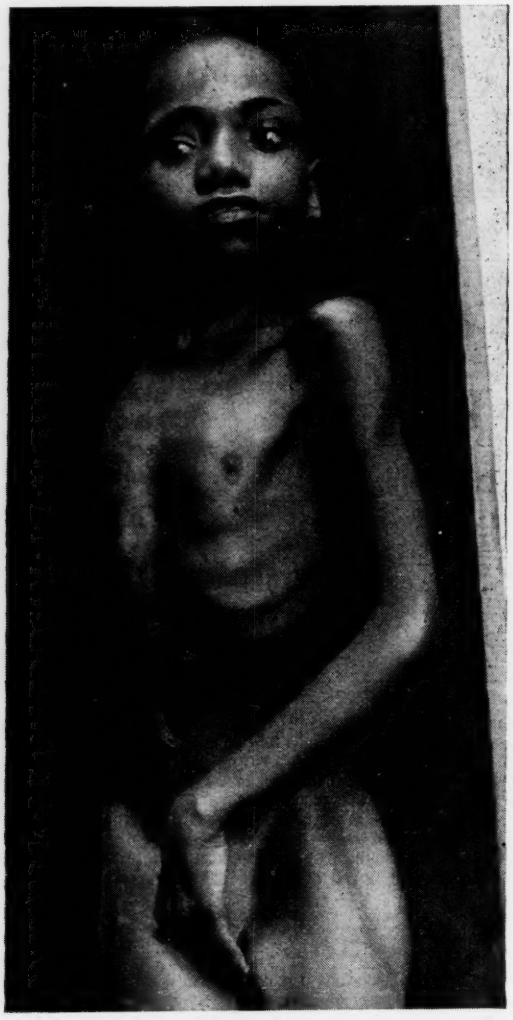

FIGURE IX.

The same patient as in Figure X, two months earlier. Internal strabismus had already developed, and advanced dysarthria was present.

of the disease. However, at the fringe of the kuru region, where kuru reaches less "epidemic" proportions and the occasional cases are sporadic rarities, it is usual to find a large proportion of these occasional cases occurring in women who have entered the previously kuru-free region by marriage from kuru-afflicted families of the kuru region. They have developed their illness in these border areas of low kuru incidence only after long years of residence outside their kuru-affected home community. Were it not for the much rarer, but most confusing, examples of a few women from communities of apparently low kuru incidence developing kuru after entry into the kuru region through

marriage, the genetic basis for the malady would appear fully substantiated.

The ætiology of kuru therefore remains obscure. No aspect of nutrition or other feature of Fore culture has yet revealed any clue to what environmental factors are operating in its pathogenesis. Genetic predisposition is strongly suggested by the type of clinical picture the disease presents, by the unusual age and sex distribution of cases, by high familial incidence in a closely intermarried community, by the phenomenon of anticipation (cases appearing at an earlier age in the second generation), by occasional genealogies wherein several siblings

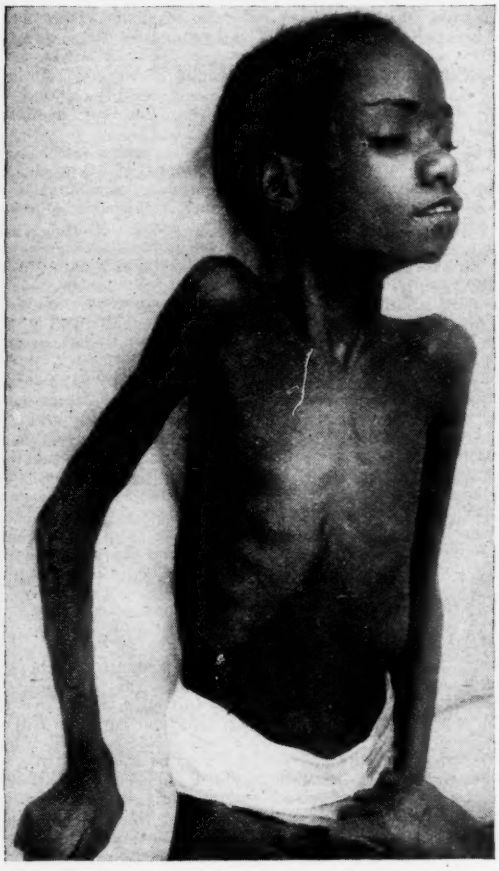

FIGURE X.

The same patient as in Figure IX two months later, and only a few weeks before her death. Her mother restrains her left hand to prevent the choreiform involuntary movements which occurred every few seconds and interfered with photography.

have died of the disease on reaching approximately the same age, and by the pattern of apparent introduction of kuru through marriage into communities of low kuru incidence on the boundary between kuru and non-kuru regions. Nevertheless, the extensive neurological degeneration found on histological study strongly suggests some toxic factor. The slight similarities to kuru found in the clinical picture and also in the pathological lesions of toxic heavy-metal damage to the brain, such as appears to be associated with copper in Wilson's hepatolenticular degeneration and is reported for chronic mercury poisoning and for manganese poisoning in Moroccan miners, make continued quest for a possible mineral or organic toxicity mandatory.

Thus far, in collaboration with Miss Lucy Hamilton, search for such a factor in extensive studies of Fore diet, pica, material used for skin painting, smoke and other sources has failed to reveal any organic agent that might be responsible for the disease, and trace-metal studies on blood, urine, C.S.F. and tissues removed at autopsy, and on food, soils, water, fire ashes and native salt preparations have not indicated any suggestion of trace-metal intoxication.

Summary.

1. A clinical, pathological and epidemiological study is described of 154 cases of a new illness resembling *paralysis agitans*, occurring in natives of the Fore linguistic and cultural group in the Eastern Highlands of New Guinea and in their immediate tribal neighbours who intermarry with them; the illness appears to be related to the group of heredofamilial chronic progressive degenerative disorders of the central nervous system.

2. The disorder affects principally adult females, but almost one-quarter of the cases are in children of both sexes. Rarely, adult males are involved.

3. The illness is apparently restricted to the Fore people—some 11,000 in number—and to only those portions of their tribal neighbours, the Kimi, Auiana, Usurufa, Kanite, Keiagana and Iagaria, who intermarry with the Fore—an estimated additional population of about 5000.

4. Preliminary neurohistological examination of six of the ten brains thus far obtained from kuru subjects has revealed widespread neuronal degeneration. The cerebellum and extrapyramidal system are most severely affected. There are also changes in the anterior horn cells, inferior olives, thalamus, and pontine nuclei. Gross and microscopic pathological study of other tissues from these 10 subjects have thus far shown no specific lesions.

5. Acute meningoencephalitis, with a mononuclear pleocytosis in the C.S.F., has been discovered in the region, but it has been impossible to establish any relationship between this infection—presumably viral—and kuru.

6. No antecedent encephalitic or meningo-encephalitic illness or any other acute infectious disease has been identified in the study of kuru, and no nutritional or toxic factor has been incriminated as of possible ætiological significance in the disorder. If the degeneration of kuru is a post-infectious phenomenon, the antecedent illness must be so mild or subtle as to escape detection by the natives and ourselves.

7. A congenital, familial tremor, which does not greatly interfere with a normal life in native society, has been found and is easily differentiated from the rapidly progressive degeneration of kuru.

8. Genetic predisposition is strongly suggested, and the evidence for it is summarized; but any ethnic-environmental variables that are operating in kuru pathogenesis have not yet been determined.

Acknowledgement.

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THE POST-OPERATIVE PULMONARY COMPLICATIONS OF ABDOMINAL SURGERY.

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THE incidence of post-operative pulmonary complications has to some extent in the past waxed and waned according to the whims of the text-book authors, and to the light in which they viewed and the regard they had for these complications. They were not unknown before the increasing use of general anæsthesia; however, their incidence has increased over the past forty years, and will continue to do so if due care is not taken. They are of two types—(i) cardiovascular and (ii) bronchial in origin.

The coming of the 1914–1918 war brought to notice the condition of "ether" or "post-operative" pneumonia. This classification was satisfactory apart from embolism for a long time, in spite of the fact that it had been stressed earlier that atelectasis was the cause of the majority of chest complications. That atelectasis was the real cause was not generally accepted until after 1930, when chest surgeons confirmed the frequency of atelectasis and the fallacy of "ether pneumonia".

With recognition of these complications, attention has been focused more on the pulmonary system, and now prophylactic treatment is a pre-operative principle in the prevention of chest complications.

The magnitude of operations performed and the types of anæsthesia used have helped cause the changes, not only in the incidence of post-operative chest complications, but also in the pathological conditions themselves, and the increasing magnitude of surgical manipulations which are performed demand by the surgeons better and better relaxation of abdominal musculature.

The patient, given an "open ether" anæsthetic, seldom develops pulmonary complications, for ether causes dilatation of the bronchial tree and secretion of normal bronchial mucus; thus the after-effects (unpleasant though they may be), such as vomiting, coughing and spluttering, make the patient treat his own chest complications before they occur.

With the introduction and perfection of narcotics, sedatives, controlled respiration and curare, the patients more often than not wake as the last stitch is being inserted, and then are given further sedatives for the sudden impact of pain; as a result of this, together with "topping-up" with numerous intravenous "cocktails", they lie still and do not cough or vomit; then come the chest complications.

However, the results of modern surgery are seldom marred by post-operative chest complications, for the following reasons: (i) improvement in the pre-operative preparation of the patient; (ii) the able execution of the operations; (iii) the improved technique of the anæsthetist. Post-operative chest complications are the concern of the surgeon, as it is thought that by pre-operative instruction of the patient, physiotherapy and keen appreciation of the patient's mental and physical make-up together with close supervision and help in the post-operative period, the patient should avoid any chest complications. If they still occur, under those conditions they can be detected and treated early, causing a minimum of disturbance to the patient's convalescence, if any at all. The greater number of post-operative pulmonary complications are avoidable.

Certain factors are more apt to cause post-operative pulmonary complications. The condition is more common in men than in women (men who smoke are more liable to bronchitis and emphysema, and are more inclined to abdominal than thoracic respiration). Abdominal operations, of course, cause an appreciable rise in each dome of the diaphragm, with the consequent inefficient basal aeration of the lungs. Morton (1944) found that complications were six times more common in men than in women.

Poor general health and debility, with or without pre-existent disease, are contraindications to all but acute emergency surgical procedures. Elective surgery undoubtedly gives far better results for these reasons. Abstinence from tobacco for two weeks is not so great a hardship as imagined, and is well worth the effort. General debility and ill health are a much harder and lengthier problem with which to deal. The patient with pyloric stenosis not only has a decreased resistance to infection, but almost always has electrolyte upsets to be corrected, as well as protein and carbohydrate insufficiency to be attended to. Chronic infection, such as sinusitis and otitis, must be rigorously controlled before operation. Obvious conditions such as tuberculosis should not need mention, but are sometimes missed.

Pulmonary complications are more common after upper abdominal operations and herniorrhaphies. The type and size of the incision are of paramount importance; not only must it give adequate exposure, it must produce as little post-operative discomfort as possible. Pain, more than anything, causes shallow breathing, and often complete immobility, the latter a fact rapidly leading to chest trouble. Pulmonary complications are practically unknown in children; but then one cannot keep them quiet. Similarly, anything that restricts abdominal and thoracic movement is apt to cause trouble. The average arm when lying across the chest (often placed there by the doctor or nurse) can cause respiratory embarrassment, and a tight abdominal binder also limits the vital capacity by at least 30%.

These factors are preventible; but there are certain factors which are not preventible in the pre-operation period, and which must be respected and watched during convalescence. Peritonitis is the major offender; not only by toxæmia and general lowering of body resistance does it cause trouble, but also by paralytic ileus with consequent abdominal distension and diaphragmatic pressure immobility.

After operations involving abdominal sepsis of any kind, a careful watch must be kept for subphrenic abscess formation; it can probably be prevented by always being borne in mind at operation. The great majority of subphrenic abscesses are secondary to some adjacent source of inflammation in the upper part of the abdomen, and this spread is probably not influenced by the position of the patient. Drye (1948) found that the pressure in the abdomen in the supine position was the same in all parts, but that in the erect position the pressure in the lower part of the abdomen increased to nearly three times that in the upper part (see also Overhalt, 1931, and Banyai, 1946). It seems, therefore, that in whatever position the patient is nursed, forces are present which cause fluid to be moved to the subphrenic region, and it is probably of little account whether the patient is nursed in Fowler's position or some other which is more comfortable and provides easier thoracic movement. After general abdominal sepsis the patient must be watched for a long time, as abscess formation may occur within days or not for weeks or even months.

Subphrenic abscess may cause pulmonary complications by direct spread with fistula formation, increasing pneumonitis with abscess formation, and embolic abscess formation, the last-mentioned being the least amenable to treatment.

Cardio-Vascular Causes.

Circulatory involvement is a less common culprit in chest complications of surgery than is the bronchial system *per se*. Although, as has previously been stated, there was with the advent of "modern anæsthesia" an all-round increase in the number of cases of chest complications, yet in later years, with greater knowledge of the vascular system, and with the more frequent use of early ambulation, there has been a large comparative fall in complications.

With adequate training to watch for early thrombosis and phlebitis, these complications with their pulmonary sequel are readily and easily recognized by all associated with surgery, and if their presence is established beyond doubt, anticoagulant therapy does much to reduce the hazards of these conditions.

Early ambulation, or if this is prevented by the surgical condition, then unrestricted and supervised exercises in the hands of competent physiotherapists not only prevent thrombosis,

peripheral circulatory stasis and pulmonary complications, but earn the gratitude of patients by virtue of a much shorter and smoother convalescence, earlier return to work and less social worry. Thrombosis is more likely to occur in the lower limbs after pelvic operations, and the early venous stasis in the pelvic, saphenous and femoral vessels is said by some to occur in the first few hours after operation. The teaching of simple post-operative exercises, and cooperation of the nursing staff in moving the patient after his return from the operating theatre do much to prevent this stasis. Massive pulmonary embolism is still seen; but the smaller emboli with lung infarction, heralded by chest pain and dyspnœa, are decreasing in frequency.

Stasis does not occur in the peripheral vessels alone (where thrombosis and emboli become the causative agents of chest complications), but also in the pulmonary vessels themselves. There are some patients who refuse absolutely to move after operation; if these patients are elderly, then they are almost certainly candidates for basal pulmonary congestion and infection.

Another form of troublesome stasis is the result of uncontrolled intravenous therapy, especially when there is any degree of associated ionic imbalance. The adjustment of fluid intake by the intravenous route when whole blood has been lost and when shock is severe, probably causes not a great deal of concern, as the quantity of fluid to produce rehydration can be estimated with some degree of accuracy. However, it is not always appreciated that if five litres of normal saline are given per day, at least 25 grammes of excess sodium chloride are given, and the additional quantity cannot be removed by the kidneys, with the result that there is retention of chloride in the extra-vascular body space. This leads, together with post-operative salt intolerance on the part of the body, to extravasation of fluid along suture lines with delayed healing, and to pulmonary œdema, often with other chest complications. This makes the correction of ionic imbalance a delicate matter, and the administration of one-fifth normal saline, with of without glucose, is the safest method of dealing with ionic imbalances. The addition of 500 units of heparin to each litre of fluid given intravenously will cause no upset in the blood-clotting mechanism, and lessens the risk of clot formation.

Congestive cardiac failure is intimately connected with vascular stasis, and sometimes the milder forms are apt to be overlooked and can cause post-operative trouble.

Certain conditions may alter the constitution of the blood sufficiently to be of note; blood dyscrasias may be mentioned, and hypoproteinæmia is often not given sufficient attention. The patient with pyloric stenosis has long ceased to have a good and sufficient protein intake, with the result that he is very susceptible to any intercurrent infection, especially of the respiratory tract.

The oral administration of fluid is readily managed and very well so by the patient; but the intravenous administration has not the guidance of the patient's feelings and hands in controlling the degree of rehydration, and careful attention is required to prevent pulmonary œdema.

Bronchial Causes.

The inhalation of vomitus under anæsthesia used to be one of the most important complications of operation in acute intestinal obstruction, but with the introduction of pre-operative emptying of the stomach and the use of endotracheal cuffed tubes, its frequency has been decreased; nevertheless, such cases still occur. Several different types of accident occur. The major airways (trachea and larger bronchi) become obstructed either completely or partially by inhaled material which is vomited during uneasy induction of anæsthesia. With obstruction of any size the patient rapidly comes dyspnœic, apnœic and cyanosed, requiring immediate removal of the obstruction by laryngoscopy or bronchoscopy with suction.

A second method of inhalation is that some œsophageal fluid slowly and surreptitiously trickles over the paralysed and insensitive separated vocal cords into the trachea. Quite a large quantity can accumulate in the lungs without causing distress. No warning may be given until, during the anæsthetic, the patient becomes distressed, with signs of an obstructed airway that cannot be accounted for, often with fatal results. Other types of material may be inhaled into the lungs, amongst which, and causing trouble, are tartar from teeth, small quantities of infected mucus from the naso-pharynx and rarely a portion of tooth or gold inlay detached during laryngoscopy. The result of these accidents is that some part of the bronchial airway becomes obstructed either completely or partially, or partially and later completely, as the inflammation resulting from the presence of the foreign body causes local swelling and further constriction.

One other condition that may occur is bronchial spasm. This can be caused by solid bodies lodging on the sensitive mucous membrane during uneasy induction of anæsthesia, but is more likely to be the result of chemical or allergic phenomena. The occurrence and treatment of "Penthothal" spasm are well known. Severe spasm causing complete emptying of the lung is rapidly fatal. Spasm may cause no post-operative complications; on the other hand, if it is not alleviated, and if it persists in mild degree for any period of time, it acts in a like manner to partial obstruction.

Bronchial obstruction leads to the accumulation of mucus in the bronchial tubes, which cannot be removed by the normal action of the ciliated epithelium, chest movement or coughing. This mucus may then form a stagnant pool with subsequent infection.

Bronchitis, one of the results of the foregoing phenomena, is the commonest post-operative complication, but fortunately is seldom of sufficient magnitude to worry the patient or the surgeon, because often it is merely an exacerbation of an already present lesion, and it tends to resolve spontaneously. Bronchitis develops almost as soon as the patient recovers consciousness, when he has mild pyrexia, a cough with some mucopurulent sputum and some scattered râles and rhonchi in his lungs. The sound of his cough is more significant than a minute examination of his chest with the stethoscope. The cough is loose and obviously bronchial, but it is not so deep, racking and distressing as in fulminating bronchitis. The patient here looks and feels well. Deep breathing, and the encouragement of the patient in early movement in bed and in coughing, will lead to a speeded convalescence. Occasionally severe and often fulminating bronchitis is seen. This is characterized by accentuation of chest signs (*vide supra*), and in contrast to the former condition, the patient has a deep bronchial cough with the production of purulent sputum, the coughing being deep, painful and prolonged. There may be pain in the chest. The patient looks, feels and is ill, and when he breathes with his mouth open the noise of bubbling in the air passages can be heard. Bronchial aspiration combined with antibiotic therapy is ideal treatment; postural drainage should also be instituted. Injections of atropine are of no use and should not be given. Detergent aerosol treatment seems to offer a more satisfactory form of treatment. Occasionally septic particulate matter is inhaled from the mouth and naso-pharynx into the bronchial tree, when a small localized bronchitis is produced involving an isolated bronchopulmonary segment. This condition remains unnoticed (probably causing no symptoms) at the time, but gradually leads to progressively spreading inflammation and the formation of a lung slough. This abscess cavity in the lung may liquify and be discharged through the bronchial tree, when the patient will be spontaneously cured; or it may remain, either causing a spreading abscess in further pulmonary tissue, or as an isolated fœtid lung abscess.

Such a patient, after a latent period of up to ten days, becomes ill, with pyrexia, sweating, cough, and often sharp pleuritic pain in the chest. X-ray examination shows, in the early stages, consolidation like a pneumonic lesion, and later, about the seventh to tenth day in 50% of cases, a fluid level can be discerned in the cavity. If the patient is not overwhelmed by fatal toxæmia, he may start to cough up the abscess—heavy, foul, blood-stained sputum; and continuing to do so, he may produce his own cure. In about two-thirds of cases spontaneous drainage is effective combined with postural drainage and intensive chemotherapy and antibiotic treatment. In a few cases these measures do not achieve resolution, and operative drainage must be considered. (Inhalation therapy, expectorants *etc.* " are complicated ways of wasting valuable time "— Maingot, 1953.) Some larger lung abscesses may be treated by lobectomy, and for a patient who has already undergone a major abdominal procedure, lobectomy may be the surest method of treatment. Certain abscesses, particularly those in the posterior pulmonary segments, may rupture into the pleural cavity; such empyemata usually require drainage. If after any abdominal operation a patient develops persistent signs suggesting consolidation or atelectasis at the lung base, then an exploring needle must be inserted into the pleural cavity. There is no other way of

certainly producing evidence of an empyema, and there is no excuse for not performing a diagnostic operation.

Atelectasis, or pulmonary collapse, is a very common post-operative complication. It is the commonest post-operative lung complication, and may occur at any time after operation, but it is most frequent in the first 24 hours. In the majority of cases the condition passes unnoticed, but when it is severe, dyspnœa and cyanosis may be present and cough is common. The symptoms, of course, vary with the degree of collapse, and in very mild cases they may be entirely absent. In severe cases the heart and the mediastinum are drawn over to the side of the lesion, and there is immobility of the corresponding half of the diaphragm, which is displaced upwards; cough increases in severity and becomes productive and painful.

W. Pasteur in 1880 regarded the collapse in atelectasis as due to diaphragmatic paralysis, and this was supported by Busiac. Elliott and Dingly (1914) laid great emphasis on the importance of bronchial obstruction, which they regarded as being the chief factor responsible for post-operative pulmonary collapse. These two hypotheses were then early put forward, and there is no doubt as to their correctness in regard to the causative factors; however, the exact mechanism of collapse is still somewhat velled. This is shown in experimental animals, for if a major bronchus is tied, immediate collapse does not occur, as it takes some 36 hours for the retained nitrogen to be removed; yet massive collapse may sometimes be seen within minutes of the cessation of a surgical procedure.

Of the many theories that have been propounded to account for post-operative atelectasis, that of bronchial obstruction by a mucus plug is now generally held; but it is of interest to establish how this plug of mucus blocks the bronchus. During consciousness, mucus is constantly being produced by the goblet cells in the bronchi and bronchioles. This mucus is moved up the bronchial tree by the action of the ciliated epithelium. During general anæsthesia the action of the cilia is reduced, which allows mucus to remain; moreover, as it is the custom to give a "drying-up" drug such as atropine or scopolamine with general anæsthesia, such mucus as is secreted is sticky and more difficult to remove.

Other factors also recognized as predisposing to post-operative atelectasis may be grouped as follows: (i) respiratory infections and irritants; (ii) hypoventilation; (iii) bronchial constriction; (iv) anæsthetic agents.

With regard to the first group, certain conditions (particularly in the upper part of the respiratory tract), irritant vapours, tobacco smoke, predispose to an increase in bronchial secretion.

In the second group, the patient who has had an abdominal operation does not ventilate well, owing to the pain of deep breathing, a conscious reflex; but fixation of the diaphragm has been shown to occur before the patient recovers consciousness. It must then be a reflex not connected with somatic nerves. It has been shown that modern anæsthesia associated with basal narcosis causes greater chest morbidity; indeed, the premedication and anæsthetic themselves must lead to some degree of hypoventilation.

In the third group, the bronchial musculature is activated principally by the vagus nerve, and stimulation of it will produce bronchial constriction. This is particularly well seen by injudicious traction on the stomach, which causes laboured breathing. Bronchial constriction then may give rise to atelectasis by squeezing the mucus and holding it in the bronchus as a plug and allowing the distal air to be absorbed; but this vagal stimulation is only temporary. However, two other factors must also be considered. Traction on the abdominal mesentery or viscera causing vagal stimulation also produces an increase of bronchial secretion, and ordinary somatic pain can give rise to bronchial constriction. These two factors are ideal for the production of atelectasis. The intravenous use of "Novocain" has been advocated to increase the vital capacity in atelectasis. It is held by some that the post-operative action of "Novocain" is by the diminution of somatic pain, and that it thus permits greater ventilation; other users, however, maintain that it acts by direct bronchial dilatation and causes an increase in vital capacity when there is no pain.

With regard to the fourth group, any anæsthetic agent which produces under-ventilation for any period of time predisposes the patient to atelectasis; there is no conclusive evidence against any particular agent. The incidence of chest complications is not materially affected by any one general anæsthetic agent, but that producing pronounced respiratory depression is to be avoided. A combination of light anæsthesia with a relaxing drug would be ideal, if it was not for the fact that curare itself is a respiratory depressant and in the course of elimination is apt to produce bronchial spasm.

If deflated lung does not respond quickly, bronchiectasis and other sequelæ may develop. A rather rare complication of atelectasis is lung abscess; it is more apt to occur from inhalation of particulate septic material (tartar from teeth, *etc.*) into the bronchial tree.

The difference in the results of bronchial obstruction depends to some degree on the cause and mechanism operating at the site of obstruction. Acute spasm of the bronchial tree may be transient and of little moment, but when it is severe it may empty the lung as though it were squeezed in a vice, with rapidly fatal results. Also of little moment is the minor degree of atelectasis that often occurs, causing no discomfort to the patient other than to make him cough once or twice, when the "ubiquitous plug of mucus" is shifted or expectorated and the condition is spontaneously relieved. This type is often not seen by the surgeon.

The stop-valve type (Jackson, 1930) is probably the more common type; it is responsible for the atelectasis which causes trouble—the massive type, or the type that progresses to infection and suppuration. If the obstruction is of short duration and in a smaller bronchiole, then little trouble, if any, will result; but with involvement of a larger structure the symptoms may be dramatic. The patient will in one minute suddenly complain of acute pain in his chest, have marked dyspnœa with the onset of cyanosis and a rapidly increasing pulse rate, and die; this is the truly massive pulmonary collapse, and the onset is often so sudden that little can be done.

Where the collapse is big but not fatal, the air distal to the blockage is absorbed, so that the lung collapses, with the production of the characteristic signs and symptoms. With persistence of this state, infection sooner or later supervenes, the result being cough with purulent sputum; and if the condition is not alleviated, lung abscess, either solitary or multiple, will be produced. When abscess formation is secondary to atelectasis, the abscess is usually solitary.

The treatment of post-operative pulmonary atelectasis is difficult; it is by prevention, and by immediate treatment of the complication when it has occurred.

With regard to prevention, it is clear that at any abdominal operation every effort should be made to avoid measures likely to inhibit movement of the diaphragm, or to restrict general body movement, in particular that of respiration. Prolonged decubitus and the assumption of the supine position may be factors in the production of pulmonary collapse, in that they render the diaphragm less mobile (Biscoe, 1927). On the other hand, it is often less distressing for the patient to cough when lying on one side than when erect. The absence of tight binders and thoraco-abdominal bandages does much to allow free chest movement. The increasing improvement in premedication and post-operative sedation is also of note. Atropine, for instance, has been cited as a trouble-maker; it dries up the bronchial secretions and causes increased viscocity of bronchial mucus when present; nevertheless, given pre-operatively for inhalation (particularly ether) anæsthesia, its advantages outweigh its disadvantages—its use after operation is unnecessary and unwarranted. Morphine, of course, is a well-known respiratory depressant, and needs no further mention. Perhaps the most important preventive measure has been the pre-operative introduction of physiotherapy, and its vigorous application in the immediate post-operative period. Such controlled activity can be only advantageous to the patient. Careful pre-operative building up of the debilitated patient and removal of foci of chronic infection are of paramount importance.

Treatment of the established condition is aimed at early expulsion of the material causing bronchial obstruction. A patient who can cough heartily and can get out of bed is well on the way to curing atelectasis without treatment. The patient should be encouraged to cough. Postural drainage is useful, and does not merely mean putting the end of the patient's bed on blocks and putting his head down. Knowledge of the lung anatomy, and, if possible, of the position of the occluding material is necessary, and exact positioning of the patient is needed. Radiological examination must not be avoided or delayed in cases of pulmonary collapse. Moderately forceful percussion of the chest with the closed first is helpful in dis-

lodging obstructing material. Timely bronchoscopy is the best treatment, when removal of the offending substance produces a marked improvement in the condition of the patient. This is an immediate matter for the surgeon. In emergencies, laryngoscopy with the patient upright in the "sniffing position" (that is, the head flexed in the cervical region and extended at the atlanto-occipital joint), with the passage of a small suction catheter into the trachea, often produced gratifying results. This procedure causes severe coughing, with dislodgment of a quantity of tenacious mucus, and may be completed by gentle suction with the catheter.

The induction of artificial pneumothorax on the side of the collapse has been advocated for relieving the immediate pain and distress, and for reducing the high negative intrapleural pressure which is associated with massive pulmonary collapse; it also may lessen the tendency of the intrapleural vacuum to drive the obstructing plugs of secretion farther into the bronchi. Recently, detergent aerosols have been successfully used. The principle is the liquefaction of the tenacious sputum formed in bronchiectasis and atelectasis; this facilitates its easy removal, either by the patient's coughing or by bronchoscopic suction.

Another condition which may be significant as a post-operative complication is bronchopneumonia. Its gravity has been much lessened by improvements in anæsthesia and surgery; nevertheless, the condition still occurs and sometimes kills. At one end of the scale are the few minor areas of patchy consolidation which cause no trouble; at the other end, however, are the complications of atelectasis and bronchitis or pneumonitis following inhaled vomitus, which have progressed to bronchopneumonia. This condition is of grave significance in debilitated persons, such as those suffering from cardiac failure, peritonitis, septicæmia, paralytic ileus and the like.

There are no certain clinical signs which can differentiate bronchopneumonia from a patchy atelectasis; but any patient who develops post-operative pulmonary complications which do not settle down should be carefully investigated in case he has bronchopneumonia. Persons who develop bronchopneumonia are invariably very ill and the outlook for them is not good. Often the best they can hope for, even in these days of chemotherapy and antibiotic treatment, is that the surgical condition may be brought under control so that full attention and the patient's whole resistance may be directed against the pulmonary complication. Careful and attentive nursing is probably more useful than the giving of many mixtures and drugs to these patients. Oxygen therapy with a "B.L.B." mask will often tide such a patient over a critical period.

Comment.

The whole theme in the pulmonary complications of abdominal surgery is prevention, and the patient's ability to cooperate in the pre-operative stage will do more to lessen these complications than any treatment known or yet to be devised.

Pre-operatively, two conditions predispose the patient to atelectasis—upper respiratory tract infections and tobacco smoking.

Post-operatively, the "stir-up" regime should be instituted, and the patient should move from one side of the bed to the other. He should be first on the left, then on the right, preferably with the head down.

An endeavour may be made to produce bronchial dilatation before, during and after operation with ephedrine. It has been found that in the first 24 hours after operation these patients cough up more sputum than those who have not had ephedrine.

If atelectasis develops, treatment must be intensified—there must be no interruption of the stir-up regime; bronchoscopy may be resorted to if the condition is urgent, or if there has been no improvement within 12 to 24 hours. Coughing of its own accord may be efficacious and may be produced (if not medically contraindicated) by the intravenous injection of 10 cubic centimetres of "Methithamide". In all these manœuvres the patient must be well supported and adequately sedated for the relief of pain, which antagonizes efficient therapy.

The worst subject for operation is the elderly man with chronic bronchitis and/or sluggish circulation, possibly with some degree of cardiac decompensation. Few town dwellers are free from bronchitis after the age of 50 years (this is more noticeable in Great Britain than in Australia), and men are worse than women in this respect.

The presence of pulmonary crepitations warrants careful investigation, especially with regard to pulmonary tuberculosis and bronchiectasis.

If by the bronchitic subject postural drainage can be effectively carried out, together with breathing exercises, emptying of the bronchi will result and make him a better subject for anæsthesia.

Morphine should be given as little as possible as a pre-operative sedative, as it depresses respiration during anæsthesia, and likewise in the post-operative period. However, with the introduction of DAPT, which is antagonistic to the respiratory depressing side-effect of morphine, this problem has been lessened.

If necessary, a few days in hospital before operation enable the patient's condition to be greatly improved; breathing exercises can be instituted and supervised and smoking should be stopped or rigidly controlled (perhaps only for the early morning cigarette, which in many persons induces marked coughing with the production of much sputum).

In many cases there is cardiac decompensation. Here pulmonary congestion causes dyspnœa and cough, and pre-operative treatment with rest, digitalis in full dosage and mercurial diuretics usually effects a good improvement.

Prophylactic treatment after operation is of greater importance, because certain features are apt to be regarded either not at all, or as unimportant, by both the medical and the nursing staff.

The following features are important: (i) A tight abdominal binder interferes with respiration. (ii) Immobilization of the patient is unnecessary, and encouragement to move about in bed should be given. (iii) The cough reflex should not be depressed by giving strong sedatives after operations; very few patients need heavy dosage with morphine derivatives. (iv) Every effort should be made to induce the patient to give a few coughs during the initial post-operative phase. It is during this phase that coughing will not cause wound break-down, but involuntary coughing later in the post-operative period is very apt to do so. (v) Atropine is useless, and as has been stated, makes the condition worse by rendering the mucus more tenacious and less readily expectorated. (vi) Knee pillows which impede the venous return from the lower limbs should not be allowed. (vii) The patient must not be allowed to become constipated.

If the patient moves about freely in bed, with help in the early stages, not only will the initial getting out of bed be earlier, but it will be much easier and more comfortable, and the risk of post-operative pulmonary complications will be decreased.

In persons with poor circulation, hypertension or cardiac decompensation, greater care than usual must be taken to prevent thrombosis of the veins (of the legs in particular). Once thrombosis is even suggested, heparin therapy should be commenced unless there are definite contraindications. It may be given by the continuous drip method or by intermittent intravenous or intramuscular injection. Heparin acts as both an anticoagulant and an antispasmodic. Vasospasm may further be reduced by the intravenous or intramuscular injection of 0·5 to 1·0 grain of papaverine.

Frequent estimations of clotting time must be made.

If pulmonary collapse occurs, the patient should be rolled on the sound side and the foot of the bed raised so that the affected lung is the highest part. The patient is encouraged to cough, and with the examiner's left hand flat over the collapsed lung the hand is smartly struck with the right fist. This postural-percussion drainage, if practised soon after collapse has occurred, loosens the plug of mucus, which is dislodged, allowing re-expansion to occur.

Emphysema is a condition which sometimes occurs post-operatively, or perhaps is first noticed in the post-operative period. It is not a complication of abdominal surgery, but rather of specialist anæsthesia. It has been seen to occur with alarming rapidity in patients in whom a muscle relaxant is being used along with artificial respiration.

Conclusion.

In conclusion, it is thought that atelectasis is the commonest post-operative lung complication of abdominal surgery, and in the majority of cases is overlooked and not recognized because of the mildness of the condition, and because of the fact that the patient is untroubled, not knowing that the condition is present.

Mild though it may be, the condition can progress to a serious state. However, it is thought with good reason that prevention by pre-operative preparation and careful immediate post-operative attention will lessen both the severity and occurrence of the condition.

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RADIATION GENETIC HAZARDS OF A POPULATION.[1]

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THE development of the Manhattan Project and the likelihood of production of vast amounts of radioelements with the consequent hazard to personnel, caused intensified research into the carcinogenic properties of radioactive substances. According to the laboratory animal under test, different amounts of a radioisotope gave a certain probability that the animal would show a malignant response. These results could therefore have been variously interpreted to apply to man. However, human experience of the ingestion of radium (radium dial painters and patients given radium water) was at hand, and together with animal observations enabled a maximum permissible concentration for ^{90}Sr to be established. Human experience is not available for the genetic effects of radiation. Understandably, then, there are various interpretations for the extrapolation of animal experiments to man.

With the advent of the nuclear bomb, questions came to be asked in various parliaments about the hazards to man arising from the consequent increase in the radioactivity of our environment. In March, 1955, the Medical Research Council was requested to appoint an independent committee to report on the medical aspects of nuclear radiation, including the genetic aspects. A similar fact-seeking body was initiated in the United States of America at much the same time. Both reports were published on the same day, June 12, 1955, and in many respects were similar and appeared reassuring. These events highlighted the question of the genetic hazard accepted in medical radiology.

As long ago as 1927, Muller demonstrated that the changes brought about in the cell nucleus by radiation, radiation-induced mutations, resulted in heritable changes in the organism. At the outset it should be said that these changes are of all types that arise spontaneously. Radiation merely accelerates the spontaneous mutation rate. The passage of ionizing quanta through the germ plasm can cause death of the cells, chromosomal structural change or gene mutation.

Death of germ cells and chromosomal structural changes are brought about particularly by acute heavy radiation dosage and therefore are not further discussed here, as it is the repeated small exposures to radiation, such as occur in medical radiology, occupational hazards and the delayed fall-out from nuclear weapons which are in the main important from the genetical viewpoint; for these repeated exposures cause gene mutation. There is no known threshold for gene mutation. That is to say, any exposure, no matter how small, must be expected to raise the mutation rate. This effect of radiation is also known to be cumulative.

Gene mutation is as insidious as the radiation which causes it. Like radiation, it can be measured only by an instrument, in this case a biological instrument, which is the progeny of the affected gene or genes. As there are already plenty of mutated genes due to spontaneous mutation in the past, any rise in the frequency of mutant genes is recorded by the biological instrument as a rise in the manifestation of the character when in nature's good time the mutated genes at last meet. Thus the mutated recessive genes must float in the population until they appear in a homozygous state as gross abnormalities and are eliminated owing to the failure of the individual to breed. Extinction of mutant genes is accomplished in large part through personal tragedy.

TABLE I.
Summary of Estimated Population Doses of Radiation to the Gonads Expressed as Percentages of Natural Background.

Source of Radiation.	Approximate Dose to Gonads as a Percentage of Natural Background.
Natural background	100
Diagnostic radiology	At least 22
Radiotherapy	?
Shoe-fitting	0·1
Luminous watches and clocks	1·0
Television sets	Much less than 1
Occupational exposure:	
Radiology and industry	At least 1·6
Atomic Energy Authority	0·1
Fall-out from test explosions	Less than 1

It is therefore seen in nature, always an experimenter, that there is already a constant mutation rate, a basic level to which the mutations produced by man-made radiation must be added. The amount of man's naturally occurring radiation exposure (from cosmic rays, gamma rays from the earth's surface, radioactive potassium in his body) is variously estimated at three to five rads over the genetically significant period. What, then, is the genetic effect of the medical use of X rays on the spontaneous mutation rate over and above the natural radiation background? To attempt to answer this begs two further questions: What amount of radiation will double the present spontaneous mutation rate? And what is the order of the extra man-made radiation to which we are exposed? In answer to the first question, from extensive experiments on *Drosophila*, whose germ cells contain few chromosomes, 50*r* has been assumed to be the doubling dose in man. In the mouse, whose germ cells contain nearly as many chromosomes as man and consequently far more gene loci than *Drosophila*, the amount of radiation may be less (Russell, 1951). The limits most acceptable to geneticists from animal experiments by analogy to man as to the amount of radiation necessary to double the mutation rate are in the range of 30 to 80 rads.

In answer to the second question—the order of extra radiation to which we are exposed—it will be seen from Table I from the Medical Research Council's White Paper (1956) that diagnostic radiology[1] gives by far the greatest

[1] Abridged from a paper read at a meeting of the Institute of Biology at the University of Durham, November, 1956.

[1] Osborn (personal communication):

Genetically Significant Radiation.

Source.	Percentage of Background.
Background	100
Radiotherapy:	
Skin therapy	1–10
Spondylitis	1–3
All others	1–5
Total	3–18
Diagnostic radiology	22–220

contribution. Osborn and Smith, who compiled the data for this estimation, emphasize that it is at least at a level of 22% of the natural background radiation (3 rads) and could be in the region of 10 times this figure (220%), which, expressed in rads, gives the range 0·6 to 6·6. American sources suggest 5 and Australian sources 3 rads. To take the most optimistic view and the most pessimistic view of the amount of radiation necessary to double the mutation rate—*i.e.*, 80 and 30 rads—and the upper and

TABLE II.

Most Optimistic.	Variables.	Most Pessimistic.
1. 80·0 rads	Doubling dose.	30·0 rads
2. 22·0 rads	Percentage increase over background.	220·0 rads.
3. 1·0 rad	Percentage increase in mutation rate.	22·0 rads
4. 0·5 rad	Heritability ratio.	0·75 rad
5. Distribution about mean		Shifting mean

lower levels of the increase over background radiation due to diagnostic radiology, there is an estimated increase in mutation rate due to this cause between the wide levels of 1% and 22% respectively.

Increase in single gene inheritance is readily "measurable" from a knowledge of the gene's mutation rate and application of the increase in mutation rate. The present knowledge of mutation rates extends to less than 20 single human genes. It is assumed from the increasing use of radiation over the last 50 years, and particularly with the

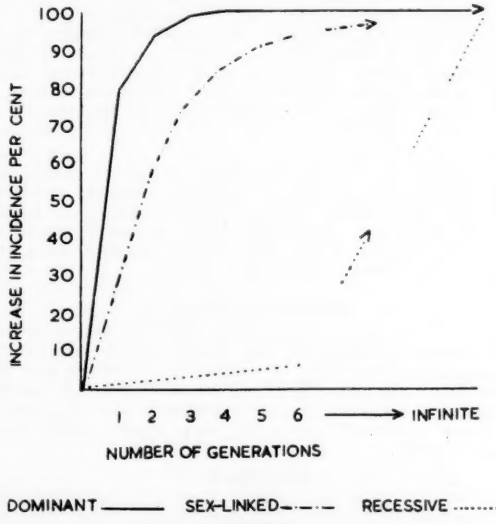

FIGURE I.

The effects of doubling the mutation rates (permanent); solid line, dominant; broken line, sex-linked; dotted line, recessive. (From Medical Research Council White Paper, 1956.)

expanding industrial application over the last 10, that radiation hazards will always be with us and will indeed increase. The effect of permanently doubling the mutation rate can be seen in Figure I (from the Medical Research Council's White Paper, 1956). It is apparent, in diseases due to single gene mutation, that dominant mutations make the full weight of their doubling rate present in a few generations, that the sex-linked are more gradual, and that the recessive take many generations. Thus, in a population the size of that of Australia the increase in genetic diseases could be calculated for the human genes whose mutation rates are known by the use of the variables discussed. However, for polygenic inheritances many assumptions have to be made, and the effect of an increase in the mutation rate is not so readily apparent. It is therefore proposed to use the following variables to obtain absolute figures for a population about the size of Australia in respect of a polygenic character. The character taken is the inheritance of intelligence quotient as determined by the intelligence test (as illustrated by Mather in the White Paper).

Let the distribution of I.Q. be represented by the Gaussian curve. Then there is a spread of 15 about the mean representing the average level of I.Q. Individuals

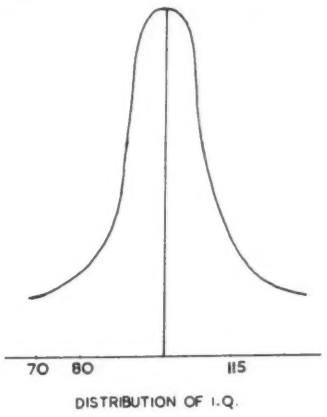

FIGURE II.

in the I.Q. range 70 to 80 require special treatment in ordinary schools, while those with I.Q. 70 require special teaching. The effect of increasing the mutation rate is to spread the curve, with more individuals at either extreme.

However, it is argued that the pressure of gene selection for higher I.Q., acting in man for some 10,000,000 years, has been raising the level of his intelligence—*i.e.*, through the preferential survival of the rare mutations whose by-products proved to be relatively more favourable. When

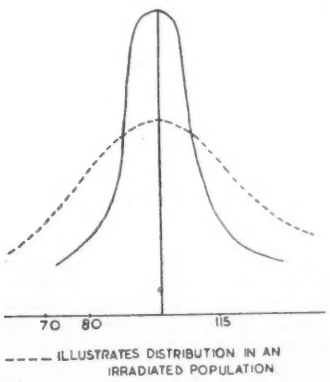

FIGURE III.

the mutation rate is increased, there is a flood of mutated genes into the gene pool, and there will be a movement of the mean away from the higher I.Q. level. It might also be argued that as most mutations are deleterious we should not expect to get more individuals with higher I.Q. by increasing the mutation rate. Thus we now move the spread curve to the left to give the same mathematical fit for I.Q. above 115 as in the original Gaussian curve. Therefore the mean moves to the left, and there will be a further increase in individuals with lower I.Q. levels.

By the use of these assumptions and variables it can now be calculated how many people occupy new places in the various I.Q. strata, as in the following tabulations.

Initial State:

Total population	10,000,000
Births per generation	4,000,000
Children of school age	1,466,666
Standard deviation of I.Q.	15
Individuals with I.Q. 70 to 80	685,100
School children with I.Q. 70 to 80	100,480
Individuals with I.Q. 70	227,500
School children with I.Q. 70	33,366

The most optimistic estimate of the effect on I.Q. of the present increase in exposure to radiation may be stated as follows:

Ultimate State:

Percentage increase in mutation	1
Heritability of I.Q.	0·5
Additional individuals with I.Q. 70 to 80	2300
Additional school children with I.Q. 70 to 80	338
Additional individuals with I.Q. 70	2700
Additional school children with I.Q. 70	400

The most pessimistic estimate of the effect on I.Q. of the present increase in exposure to radiation may be set out as follows:

Ultimate State:

Percentage increase in mutation	22
Heritability of I.Q.	0·75
Additional individuals with I.Q. 70 to 80	165,600
Additional school children with I.Q. 70 to 80	24,290
Additional individuals with I.Q. 70	148,300
Additional school children with I.Q. 70	21,750

Ultimately the diseases known to be produced by single gene mutation would reach a level proportionate to the increase in the mutation rate in the population also. However, diseases which have some genetic background and

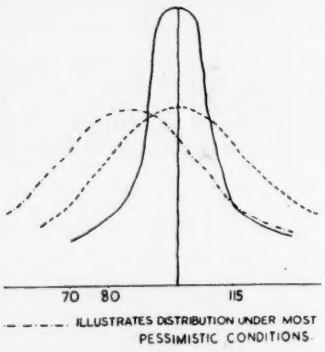

FIGURE IV.

most of the variations between human beings cannot be traced to the action of single genes, as is illustrated in the discussion on I.Q. Mental diseases and mental deficiency fall in this category and are the most extensive group of diseases in which hereditary causes are known to be important; combined they account for nearly half the hospital beds provided in the United Kingdom. After very many generations, the White Paper states, their incidence might also be doubled if the mutation rate was doubled.

Conclusion.

The truth lies somewhere between the most optimistic and the most pessimistic views, for enough has been said to show a "measurable" trend due to the present increase in man-made radioactivity. However, the truth must await further experimentation and observation, and it must be realized that we are interpreting largely by analogy from animal to man. But we cannot afford to wait for the answer. We have to take a well-informed guess and assess now the usefulness of radiation to the present population and its harmfulness to later generations—for there is no going back in heredity. A 5% to 10% increase in the mutation rate would not be an unreasonable figure.

Enough has been learnt about the effects of radiation due to man-made radioactivity to make the Atomic Energy Authority determined that the pneumonokoniosis of the coal-mining industry shall not be paralleled in this industry. They have set a very high standard with regard to occupational exposure to radiation and will be satisfied with nothing less. A similarly high standard applies to the medical radiology examinations at Harwell. Nevertheless, the small contribution shown in Table I must be expected to rise as more people become engaged in this industry.

The American report has recommended that the population shall not be exposed to more than 10*r* in the genetically significant period, and the Medical Research Council, although not recommending a specific maximum permissible dose level for the population, thinks that it is not likely to be more than twice the dose already received from the natural background and that it may possibly be lower. Thus the contribution from diagnostic radiology is certainly already approaching (and may even have passed in some countries) this maximum permissible level, and the nuclear programme must be allowed *Lebensraum* within this limit. The Adrian Committee is examining this question in the United Kingdom. It is not intended that 6*r* or 10*r* delivered to the whole population is to be regarded as a harmless limit, but rather as a level beyond which the hazards of the use of radiation may well outweigh its benefits. If the same benefits could be obtained with less radiation delivered to the population, this is to be desired.

If the need to reduce this medical contribution was widely understood, the present high level of genetic dose would probably be decimated. Medical practitioners using radiation as a diagnostic tool should be familiar with radiation genetics. Clinicians should be aware of those examinations which contribute most to the genetic load. It is the radiologist's responsibility that the dosage rate of all equipment should be known and the operators educated in radiation protection.

It is presumed that no one wants to see introduced the labour of keeping records for patients' exposure levels or restrictive legislation. Rather, the goal should be education in radiation protection, and further surveys of population exposure of the type carried out by Osborn and Smith in the United Kingdom.

Acknowledgements.

Dr. T. C. Carter demonstrated the I.Q. model at the Commonwealth Conference on Radiation Protection in London in October, 1956. I should like to thank him for calculating the figures for a population of 10×10^6 and for his generous help at Harwell throughout the year of my Travelling Fellowship from the New South Wales State Cancer Council.

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ILLNESS IN TWINS: IV. POLYCYSTIC DISEASE OF THE KIDNEYS.[1]

By R. K. DOIG.

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THE condition of polycystic kidney is of interest from several points of view. To the obstetrician it is an uncommon cause of obstructed labour, associated with stillbirth or neonatal death. The pathologist examining these infants is struck by the frequent presence of other malformations, and by the similarity to the adult form of the disease. Such differences as do exist in the cysts have been demonstrated by Lambert (1947) to depend on the different relationships to the glomeruli and other parts of the nephron. The clinician who diagnoses polycystic disease of the kidneys in the adult has usually seen a patient in the fourth or fifth decade with renal pain or colic, urinary tract infection or uræmia (Rall and Odel, 1947), or rarely with intracranial aneurysm (Brown, 1951). Commonly there may be no symptoms, or there may be only the swelling in one or both sides of the abdomen.

The familial nature of the condition is shown in numerous reports; for example, Cairns (1925) and Bull (1910, 1918) described families with affected members in three generations, and Fuller (1929) involvement of four generations. Fergusson (1949) reviewed data about 84 families with 307 affected members. He showed that the sex incidence and transmitting sex incidence were equal. He further commented that in eight families with neonatal cases there were no adult cases, and in his own studies he was unable to detect latent disease in childhood where it might be expected. Fergusson concluded that the neonatal form was inherited as a recessive trait and the adult form as a dominant. Interpretation of family studies of the late adult form is rendered difficult by the asymptomatic cases and the late onset of clinical manifestations.

Twin studies on polycystic kidneys suffer from lack of diagnosis of ovularity. Wiedemann (1953), quoting Werner and other sources, refers to 17 twin pairs of whom nine showed concordance; but ovularity was diagnosed in only two (neonatal) cases. Wiedemann then went on to describe the case of identical male twins, both of whom had polycystic kidneys, one dying at the age of 37 years. Their father also died from polycystic kidneys. These twins exemplify the varying expression of the disorder to which Fergusson also referred. The following case report concerns identical male twins, one of whom has died from polycystic kidney disease. It is one of several concordances seen in a consecutive series of 116 twin pairs. Discordances in the 35 identical pairs have been listed in an earlier paper (Doig and Pitman, 1957).

Report of a Case.

The index twin, a man, aged 43 years, was admitted to the Royal Melbourne Hospital on December 12, 1954, with a history of upper abdominal pain of eight weeks' duration. He gave a past history of hæmaturia following a football injury 12 years before and of spontaneous hæmaturia at about the same time. He was also said to have a high blood pressure. For eight weeks the patient had noted pain across the upper part of the abdomen, describing it as constricting in character. There was a feeling of pressure under the right costal margin, although no actual mass had been felt by the patient. For the same period he had noted loss of energy, and for one week he had had an episode of vomiting and diarrhœa.

On examination, the patient was a healthy looking man; his weight was 143 pounds, and his blood pressure was 210/120 millimetres of mercury. Large, firm irregular masses were felt in the abdomen, extending from each costal margin to below the level of the umbilicus, the right being larger than the left. The masses could be ballotted from the loin and were slightly tender. There was no evidence of heart failure. The urine had a specific gravity of 1006; it contained a trace of albumin, but no sugar, no casts and no cellular elements. The blood urea content was 78 milligrammes per 100 millilitres. The urea clearance (after urea) was 46%, and the hæmoglobin value of the blood was 12·1 grammes per centum. The report on an intravenous pyelogram was as follows:

> Renal outlines not defined. Group of small calcified opacities in right hypochondrium ? renal calculi. No appreciable dye excretion by the left kidney up to 95 minutes from time of injection. Trace of dye was excreted by the right kidney first seen at 23 minutes but the right pyelogram is not seen filled. No dye seen in the bladder.

A retrograde pyelogram was reported on as follows:

> The tip of the right catheter just entered the bladder. The left catheter passed well up into the left loin and dye injected up it filled the grossly dilated pelvis and calyces. The kidney appears malrotated with the calyces directed posteriorly rather than laterally.

The patient was discharged home, and carried on his work as a school teacher until January, 1957. He then had an attack of severe diarrhœa with poor appetite and loss of weight. On examination in February he was dehydrated and sallow and his blood pressure was 120/80 millimetres of mercury. His urine contained a trace of albumin. The hæmoglobin value was 85%, and the blood urea content was 180 milligrammes per 100 millilitres. He seemed to be improving, but died suddenly a few days later from coronary occlusion. No post-mortem examination was made.

His male co-twin was examined on February 20, 1955. He gave the following medical history. He had had scarlet fever at the age of 12 years, and had undergone a herniorraphy at 21. He was rejected for Army service at the age of 30 years because of high blood pressure and albuminuria. Despite this, he carried on with long-distance cycling without ill effect till about this age, and afterwards played tennis and golf. The index twin was also active in sport. In 1952 the co-twin had consulted his doctor because of tiredness, irritability and poor concentration. These symptoms were reasonably attributed to concern about his work. They have since disappeared, perhaps because of a change in occupation.

On examination, the co-twin was a healthy-looking man weighing 136 pounds; his blood pressure was 186/98 millimetres of mercury. The liver edge was palpable, and both kidneys were palpable below the costal margin, the left being larger than the right. The urine had a specific gravity of 1004, and contained albumin, no sugar and numerous pus cells; it was sterile. The blood urea content was 45 milligrammes per 100 millilitres. The urea clearance (after urea) was 64%. The hæmoglobin value was 14·9 grammes per centum. The report on an intravenous pyelogram was as follows:

> The kidney shadows are not well defined, but it can be said that they are almost certainly very large. Marked delay in excretion of dye on both sides. Both pyelograms are very large. They are not well seen because of poor concentration of dye and overlying gas shadows. The pyelograms suggest developmental anomalies with poorly formed minor calyces and generally unusual shape. There is evidence of pressure from above on the right upper calyces indicative of a space-occupying lesion such as a cyst. The general picture is not typical of polycystic kidneys and carcinoma cannot of course be excluded. Over the left side of the 5th sacral segment is an oval calcified opacity of uncertain nature, possibly a calculus in a diverticulum of the bladder.

This twin has remained well although he is concerned at the death of his brother. His kidneys are reported by his physician to be larger.

Both these twins lived in the country and were not seen together. They are reported to have looked alike. Their blood groups are the same: A2, M N S, Rh1.rh, C^w–, P + Duffy + Kell–. The father died at the age of 59 years after about 14 days' illness, from heart disease. The mother is well at 70. There are no siblings. Both twins were married (both wives have duodenal ulcers). The index twin had no children; the co-twin has a daughter, who is well.

Comment.

There is little reasonable doubt concerning the diagnosis in these two subjects, although the radiological appearances are not entirely characteristic. Similarly the diagnosis of

[1] Work done with the aid of a grant from the Nuffield Foundation.

ovularity is reasonably certain, although the twins were not seen together. This case adds more weight to the concept that polycystic disease of the kidneys is a genetically determined disease.

Summary.

The concordant appearance of polycystic disease of the kidneys in identical male twins is reported, with brief reference to the present view on the genetic pattern of the adult form of the disease.

Acknowledgements.

I wish to thank Dr. J. L. Frew for permission to report the index twin and for the follow-up notes, Dr. J. E. Joseph for help in investigation of the co-twin, and Dr. M. Brous for translation of Wiedemann's paper.

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Reviews.

Tuberculosis Nursing. By Jessie G. Eyre, M.A., S.R.N., B.T.A. (Hons.); Second Edition; 1957. London: H. K. Lewis and Company, Limited. 8½" × 5½", pp. 372, with 98 illustrations. Price: 25s.

ALTHOUGH tuberculosis is definitely on the wane, complete abolition of this disease is still a long way off, and the second edition of Miss Eyre's book is timely. The book is a pleasure to read, well set out with clear type and good diagrams, and typographical errors are very few.

Sections of the book deal with social problems and the machinery available for their relief in England. In Australia conditions are somewhat different, but the main principles outlined are applicable to this country. Miss Eyre covers the subject of the nurse and tuberculosis from all aspects. It is pleasing to see stress laid on the all-important nurse-patient relationship and on the help the nurse can give to the patient by a sympathetic understanding of his disease and the problems associated with it.

There are a few points on which one could criticize the book, the most important, perhaps, being in the chapter on bone and joint tuberculosis, written, not by Miss Eyre, but by Miss M. Reed. Miss Reed does not stress the application of anti-tuberculous drugs or mention the changes which their use has produced on the picture of orthopædic tuberculosis, the emphasis today being not on fixed joints, but on mobile ones. Miss Reed's treatment in the minds of many, although it is still a controversial subject, is some years out of date.

Criticism of Miss Eyre's work would be that at the time of writing (1956) she makes no mention of the newer anti-tuberculous drugs such as "Pyrazinamide" and cycloserine, which, although not freely available in the United Kingdom, at that time were widely mentioned in the literature. Another point to which exception could be taken is the statement that the size and severity of a reaction to the intradermal injection of tuberculin may be an indication of the severity and type of infection; it is safer and surer to interpret a positive reaction to tuberculin as indicating infection, and that only, and to rely on other information to determine whether the infection is new or old, active or inactive, or due to human, bovine or B.C.G. organisms.

However, taken over all, this is an excellent book, and is to be highly recommended to all interested in tuberculosis nursing.

The Year Book of Endocrinology (1956-1957 Year Book Series). Edited by Gilbert S. Gordan, M.D., Ph.D. F.A.C.P.; 1957. Chicago: The Year Book Publishers. 7½" × 5", pp. 384, with 73 illustrations. Price: $6.75.

THIS book consists of a series of articles abstracted from journals published during the last year, grouped together under the major endocrine systems. There have been great advances in this subject over the last year, and these are well discussed. The adrenal gland has a prominent place. The adrenal hormones have been further purified, and it is now well established that the medulla produces three closely related compounds. Disease states resulting from aldosterone hypersecretion are described. The thyroid hormones have been extensively investigated, and it is shown that the multiplicity of such hormones explains the varying clinical manifestations of thyroid over-function. An exciting advance has been Murray Barr's demonstration that the chromatin pattern reveals genetic sex in cells from buccal and vaginal scrapings and from skin biopsy, and in neutrophils in a blood film. Altogether many stimulating advances are described in this valuable little book.

The Electrocardiogram: Its Interpretation and Clinical Application. By Louis H. Sigler, M.D., F.A.C.P., F.C.C.P., F.A.C.C.; Second Edition; 1957. New York and London: Grune and Stratton. 9" × 6", pp. 328, with 195 illustrations. Price: $8.75.

OF the many facets of cardiac activity which may be studied, recording of the heart's electrical activity is an established clinical procedure. The great clinical value of the method is indicated by the large number of texts on the subject, and the appearance of a second edition of one suggests that it has something special to offer. It is, however not clear what this is.

The book gives a concise account of the electrocardiographic features of disorders of rhythm, of conduction and of myocardial disturbances. Short accounts are included of the effect of trauma and of many drugs on the electrocardiogram.

The subject is presented as to a reader with no knowledge of physics, so that the chapters on "The Foundation of the Electrocardiogram" are extremely elementary and of little help in understanding electrocardiograms, especially as there is frequently confusion between potential and current. Although the variations and abnormalities of the electrocardiogram are presented as an empirical study of correlation between types of tracing and clinical observation, at times interpretation is based on theory. This is unfortunate, for the author has retained in this edition a chapter on "Circus Movement Theory" which concludes as follows: "The theory of circus movement appears to have been disproved."

The concept of electrical vectors and the more recent idea of ventricular gradient are mentioned, but no attempt is made to consider the more important problem of treating the heart's electrical activity as a three-dimensional problem.

Illustrations are adequate in number, but often are not of the highest technical quality.

Obesity: Its Cause, Classification and Care. By E. Philip Gelvin, M.D., F.A.C.P., and Thomas H. McGavack, M.D., F.A.C.P.; 1957. New York: Paul B. Hoeber. 8" × 5½", pp. 160, with six illustrations. Price: $3.50.

OBESITY is an exceedingly common condition, which because of its complications merits close study. The cause, classification and care of obesity are discussed by E. Philip Gelvin and Thomas H. McGavack in a book of useful size. Their work is based upon their experience at the obesity clinic of the Metropolitan Hospital, New York, where they studied the management of overweight patients. As they point out: "It is the family physician who is best qualified to identify and treat the obese individual, not reducing salons, food faddists and the purveyors of patent medicines."

Successive chapters of the book deal with the clinical features, physiology, classification, ætiology and management of obesity. As the authors state, it is difficult to give an

adequate and satisfactory definition of obesity, because of the difficulty of establishing the optimum weight of an individual. Height-weight tables and skinfold measurements are useful guides in determining the satisfactory weight of subjects. The chapters on the physiology of obesity give an adequate description of this complicated subject.

The classification of obesity also presents difficulties because the common division into exogenous and endogenous types serves no useful purpose. The authors suggest that a classification of obesity according to its origin may be helpful, but admit that every arrangement has its shortcomings.

The ætiology of obesity is the subject of a good discussion in which hereditary, psychological, nervous, metabolic and dietary factors are all shown to play important parts. Endocrine abnormalities, however, play minor roles. In fact endocrine abnormalities have very little influence in the causation of obesity, but disorders of the hypothalamus are considered to be most important elements in producing overweight. It is also of interest to note that obesity in childhood, which usually corrects itself by the time adult life is reached, is considered by the authors to be mainly due to over-eating.

In the management of obesity the authors advocate a diet of 1000 or 1200 Calories, together with the use of dextroamphetamine for a limited period. By such means weight may be satisfactorily reduced, and thus the hazards of obesity, such as degenerative diseases of the cardio-vascular system and *diabetes mellitus*, be avoided. The authors stress the necessity for regular attendance at the clinic by the patient and for careful explanation of the rationale of treatment by the physician.

The book, which is well documented with references, should prove most useful to any physician in the understanding of the subject, which is obviously of great practical importance.

The Medical Annual: A Year Book of Treatment and Practitioner's Index. Edited by Sir Henry Tidy, K.B.E., M.A., M.D. (Oxon.), F.R.C.P., and R. Milnes Walker, M.S. (Lond.), F.R.C.S.; 75th Year; 1957. Bristol: John Wright and Sons, Limited. 8¾" × 5½", pp. 641, with 52 plates. Price not stated.

THIS book provides a review of the literature of the year, and the editors also have enlisted the help of leading specialists to contribute articles on subjects of outstanding importance at the present time. The book commences with a general review of the current literature. The individual articles are then arranged in alphabetical order, consisting essentially of abstracts from journals published during the year. Included is a series of cinephotographs of stenotic aortic valves in an article on aortic stenosis by Kent Harrison. In an interesting article on coagulation the modern theory is simply explained. An account is given of the physiology, method and indications for the use of hypothermia, which is described as most valuable in cardiac and cerebral surgery. The book concludes with a section on pharmaceutical preparations; the dose and use of each new drug are briefly described. This is a valuable and informative book for the general practitioner.

Meat Hygiene. Contributors: V. E. Albertsen, R. Benoit, T. Blom, Phyllis G. Croft, C. E. Dolman, H. Drieux, R. I. Hood, M. J. J. Houthuis, A. Jepson, H. H. Johansen, M. M. Kaplan, S. O. Koch, G. Scaccia Scarafoni, G. Schmid, F. Schönberg, H. Thornton; 1957. Geneva: World Health Organization. 9¼" × 6¼", pp. 528, with many illustrations, some coloured.

"SINCE the dawn of history man has had to match his wits against two-, four-, and six-legged adversaries in a struggle for existence. Once upon a time when he won these contests he ate as much of his opponent as he could stomach." So commences a comprehensive and well-illustrated monograph on meat hygiene issued this year by the World Health Organization. Today the idea of eating meat in the crude way described in the quotation is abhorrent to most people; with the development of agriculture and animal husbandry, however, mankind has come "to depend increasingly for strength and sinew upon the cooked flesh of tamed herbivores". At the same time the widespread use of such food has brought in its train many problems. Meat is a perishable commodity, and its poor handling, whether by the slaughterer or the retailer (or the housewife), is likely to result in ill health and wastage.

The WHO monograph, which must be unique in its field, contains contributions from meat hygiene experts in many parts of the world. It deals with practical health problems of the meat industry, from the care and slaughter of animals to the hygienic processing and marketing of meat and the sanitary disposal of the by-products. It also covers such wider aspects of meat hygiene as the epidemiology of meat source diseases, training of meat inspectors and meat hygiene problems in a number of countries. In addition much detail on laboratory techniques for the detection of meat-borne diseases, on meat regulations in various countries and on the design of abattoirs is given in annexes.

This book illuminates many recent advances and problems in the numerous and diverse aspects of this vast subject for the benefit particularly of the responsible authorities and of students in public health and in veterinary science. It will interest only a limited group of medical practitioners; but where it does appeal, it will be found to be most comprehensive.

Bedside Diagnosis. By Charles Seward, M.D., F.R.C.P. (Edin.), with a foreword by Lord Cohen of Birkenhead, M.D., D.Sc., LL.D., F.R.C.P., F.A.C.P., F.F.R.; Fourth Edition; 1957. Edinburgh and London: E. and S. Livingstone, Limited. 7¼" × 4½", pp. 456, with several illustrations. Price: 21s. (English).

THE study of signs and symptoms in clinical medicine by the anatomical and physiological approach, as presented in books on clinical methods, is the way in which students are introduced to clinical medicine. Then, having gained the ability to elicit signs and symptoms satisfactorily, they study descriptions of diseases, as found in standard textbooks and monographs. This process of deciding which disease complex is to be studied is difficult, and this book, which contains clear and accurate information, assists in this process of integration.

There are chapters on pain, anæmia, hæmorrhagic diseases, and bleeding from the nose, gastro-intestinal tract, respira- and bleeding from the nose, gastro-intestinal tract and respiratory and urinary tracts. There are also chapters on cough, dyspnœa, tachycardia, vomiting, diarrhœa and jaundice. The chapters on psychogenic symptoms, debility and pyrexia are most attractive and helpful. There is first a short consideration of the physiology, which is followed by the diagnostic approach and method of analysis of symptoms, and later short descriptions of important diseases are given. There is a good index with many cross references, and a carefully compiled synopsis precedes each chapter.

The principles of approach to disease, as outlined in this book, should, as Lord Cohen of Birkenhead states in the foreword, "have laid a foundation which will remain firm whatever stresses the superstructure of later knowledge may impose upon it. And even the experienced practitioner will learn much from its text".

Psychoanalysis and Psychotherapy: Developments in Theory, Technique and Training. By Franz Alexander, M.D.; 1957. London: George Allen and Unwin, Limited. 8½" × 5½", pp. 320. Price: 25s. (English).

FRANZ ALEXANDER, the author of this book, is the director of the Chicago Institute for Psychoanalysis, where he originated the psychoanalytical studies on which the discipline known as psychosomatic medicine is founded. In this book he recommends that those psychiatrists who do not wish to be psychoanalysed should be given theoretical and clinical training by experienced psychoanalysts, so that they may be better fitted to practise therapy on psychoanalytical lines. Alexander considers that this training should be available through psychoanalysts being appointed to university departments of psychiatry, just as he was appointed Clinical Professor of Psychiatry at the University of Illinois. The purpose of the book seems to be to convince psychoanalysts that they should undertake such work.

A Student's Histology. By H. S. D. Garven, B.Sc., M.D. (Glas.), F.R.S.E., F.R.F.P.S.G.; 1957. Edinburgh and London: E. and S. Livingstone, Limited. Price: 55s.

MOST British books on histology hitherto have treated the subject in a brief, rather cursory way, and obviously as a minor part of a course in physiology. The time for that has long since passed; histology is best dealt with by anatomists, and the most satisfactory text-books at present available are the larger ones by anatomists on the Continent or in North America. The book under review, while still the product of a physiology department, goes some way towards improving the British standard. It opens with a useful introduction on microscopy, follows with correlation of structure and function and an account of the tissues, and proceeds to an orderly examination of the systems in

the usual fashion. Each chapter is reasonably up to date, clearly written and amply illustrated—although the order of presentation is not what every teacher would choose. Useful features are the explanations of Greek and Latin terms, a guide to further reading and the historical summary at the back.

The illustrations, some coloured, are for the most part diagrammatic. This sets the general tone of the work as one of purely didactic instruction, with little attempt to arrive at a reasoned scientific basis. The fact that histological technique is treated cursorily reinforces this view. No doubt there can be too much science and too much technique for students of the type for which this book seems to be intended; on the other hand, most medical students do derive some benefit from knowing the rationale, and most would prefer illustrations more nearly resembling the sections they are actually looking at. In brief, this is a quite good book of histological instruction, but it lacks distinction and places a definite upper limit upon what could usefully be taught to medical students.

Aids to Ophthalmology. By P. McG. Moffatt, M.D. (Lond.), M.R.C.P., F.R.C.S. (Eng.), D.O.M.S.; Eleventh Edition; 1957. London: Baillière, Tindall and Cox. 6¾" × 4", pp. 296, with 118 illustrations. Price: 10s. 6d.

THIS is a clear, short little book especially valuable to students. It is well laid out, and most of the conditions affecting the eye are briefly described together with the appropriate treatment. Surgical management is given a chapter, and there is a helpful section on pædiatric ophthalmology. The book concludes with a useful list of examination questions.

J.A.M.A. Clinical Abstracts of Diagnosis and Treatment. Published with the approval of the Board of Trustees. American Medical Association; 1957. New York and London: Intercontinental Medical Book Corporation with Grune and Stratton, Incorporated. 8½" × 5½", pp. 566. Price: $5.50.

THIS volume consists of abstracts of articles from journals published throughout the world and selected by *The Journal of the American Medical Association*.

It provides glimpses of the progress in all fields of medicine, giving a short and practical survey of the current world medical literature. It more than adequately achieves what it sets out to do.

Collected Papers of the Mayo Clinic and the Mayo Foundation. Edited by Richard M. Hewitt, B.A., M.A., M.D., John R. Miner, B.A., Sc.D., James R. Eckman, A.B., M.A., Ph.D., M. Katharine Smith, B.A., Carl M. Gambill, A.B., M.D., M.P.H., Florence L. Schmidt, B.S.E., George G. Stilwell, A.B., M.D., and Guy Whitehead, B.A., M.A., Ph.D. Volume 48, 1956; 1957. Philadelphia and London: W. B. Saunders Company. Melbourne: W. Ramsay (Surgical), Limited. 9¼" × 6", pp. 786, with many illustrations. Price: £6 5s.

THIS book represents the work of the Mayo Clinic and Mayo Foundation for the year 1956. The articles, which have already appeared in journals throughout America, have been selected with the interest of general practitioners and surgeons in mind. But material representative of specialities—namely, skin and basic sciences—has also been included with such subjects as the physiology of muscular contraction and the biochemistry in dermatomyositis. However, concentration has been upon the surgical aspect of disease. The volume concludes with a section on physical medicine and rehabilitation, including the care of the patient with a terminal malignant condition.

Emergencies in General Practice. Specially commissioned articles from the *British Medical Journal*, January, 1955, to June, 1956 (fully revised); 1957. London: British Medical Association. 8½" × 5½", pp. 480, with illustrations. Price: 25s.

THIS book contains a selection of articles published in the *British Medical Journal* in 1955 and 1956 under the heading "Emergencies in General Practice". The term emergency has been interpreted widely. Most of the conditions discussed are acute clinical emergencies encountered in general practice such as shock, apoplexy, severe asthma, the "acute abdomen" and ingestion of poisons; the management of acute psychiatric states is also described. There is a most valuable section on common mishaps such as penetrating foreign bodies and finger injury, as well as a chapter on drug reactions and injection accidents. Also discussed are conditions which need careful elucidation to manage effectively, such as "fits", giddiness and severe bronchitis. This is an invaluable book for general practitioners.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Effect of Radiation on Human Heredity." Report of a Study Group convened by WHO together with papers presented by various members of the Group; 1957. Geneva: World Health Organization. 9½" × 6¾", pp. 168, with two illustrations. Price: Cloth bound edition at £1, $4.00, Sw. fr. 12.

The title is self-explanatory.

"Clinical Gastroenterology", by Eddy D. Palmer, M.D., F.A.C.P.; 1957. New York: Paul B. Hoeber. 10" × 7", pp. 640, with 216 illustrations. Price: $18.50.

Intended for those whose main interest is bedside medicine.

"Progress in Gynecology: Volume 3", edited by Joe V. Meigs, M.D., and Somers H. Sturgis, M.D.; 1957. New York and London: Grune and Stratton. 9" × 6", pp. 800, with many illustrations. Price: $15.50.

The previous volume appeared five years ago.

"Anesthesia and Otolaryngology", by Donald F. Proctor, M.D.; 1957. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 9" × 6", pp. 296, with 33 illustrations. Price: 77s.

The author is now Assistant Professor of Laryngology and Otology and was formerly Professor of Anesthesiology at the Johns Hopkins University School of Medicine.

"Medical Treatment", by Kenneth Maclean, M.A., M.D., F.R.C.P., with chapters on the tropical diseases by Colonel W. R. M. Drew, C.B.E., F.R.C.P., D.T.M. & H.; 1957. London: J. and A. Churchill, Limited. 9¾" × 6", pp. 704. Price: 50s. (English).

Designed primarily for general practitioners, house officers and senior students.

"Modern Perinatal Care", by Leslie V. Dill, M.D., F.A.C.S.; 1957. New York: Appleton-Century-Crofts, Incorporated. 9¼" × 6¼", pp. 322, with 50 illustrations. Price: $6.50.

"This book has as its aim the crystallization of present day thought on the care of the woman antepartum and postpartum."

"The Practice of Industrial Medicine", by T. A. Lloyd Davies, M.D. (Lond.), F.R.C.P. (Lond.), with a chapter on "The Hazards of Coal Mining", by J. M. Rogan, M.D. (Edin.), F.R.C.P. (Edin.); Second Edition; 1957. London: J. and A. Churchill, Limited. 8½" × 5½", pp. 292, with 15 illustrations. Price: 30s. (English).

Designed for the practitioner undertaking the work of the industrial medical officer for the first time.

"Changes in Liver Cell Elements during Stimulated Protein Synthesis: A Cytochemical Study", by G. F. Bahr; 1957. Stockholm: Acta Radiologica Supplement 147. 9¼" × 7¼", pp. 112, with 59 illustrations. Price: Sw Kr. 25.

The title is self-explanatory.

"The Year Book of Dermatology and Syphilology (1956-1957 Year Book Series)", edited by Rudolf L. Baer, M.D., and Victor H. Witten, M.D.; 1957. Chicago: The Year Book Publishers, Incorporated. 7¾" × 5", pp. 464, with 62 illustrations. Price: $7.00.

One of the Practical Medicine Series of Year Books.

"The Year Book of Cancer (1956-1957 Year Book Series)", compiled and edited by Randolph Lee Clark, jnr., B.S., M.D., M.Sc. (Surgery), D.Sc. (Hon.), and Russell W. Cumley, B.A., M.A., Ph.D.; 1957. Chicago: The Year Book Publishers, Incorporated. 7¼" × 5¼", pp. 576, with 210 illustrations. Price: $7.50.

A new member of the Practical Medicine Series of Year Books.

The Medical Journal of Australia

SATURDAY, NOVEMBER 23, 1957.

KURU.

LESS than thirty years ago the Central Highlands of New Guinea were penetrated by Europeans for the first time, and a blasé world found a passing diversion in stories of a new Shangri-La. Subsequent happenings in the area have been well summarized by Ronald M. Berndt[1] in the introduction to his study of a "cargo" movement in the Eastern Central Highlands. In brief, the initial explorations in 1930 were followed by the entry of prospectors and the establishment of government posts and mission stations. From about the end of 1934 to the time of the Japanese invasion the Highlands were largely closed to further European penetration. This policy was perforce broken down during the war, and since then the official aim appears to have been to bring the region under full control. This is a large and exacting task, which is still proceeding, but it has brought in its train much that is of great interest to the anthropologist, the medical scientist and others. One such discovery, which will undoubtedly intrigue the medical world, is the disease syndrome, occurring in the Eastern Central Highlands and known to the natives as "kuru", which is described elsewhere in this issue by V. Zigas and D. C. Gajdusek.

Just how long kuru has been present in the Eastern Highlands it is difficult, perhaps impossible, to find out. Information on this point, if it could be obtained, would be of great help in understanding the syndrome and its ætiology. However, there seems little doubt that it has been present for many years. It was observed by R. M. Berndt in 1951-1952 in the course of social anthropological work. In the paper on a "cargo" movement already referred to, he describes a phenomenon of shivering and shaking occurring amongst the members of certain linguistic groups, which followed the blowing of "a cold wind", the *zona*, across the land. This shivering was ascribed to spirit possession: "the *zona* blows, and as the wind touches the people—men, women and children—they become possessed by the spirit which is within the *zona*, and start to shiver as if all have been 'poisoned' by *nagliza* sorcery". Berndt states that this shivering continues involuntarily, but intermittently, for an undetermined period; then apparently it ceases. The important point is that it "is similar to (but distinguished from) *a shaking sickness caused by sorcery*" (the italics are ours). In a later paper[2] Berndt describes this second condition ascribed to sorcery:

> It is comparatively common and involves partial paralysis and lack of muscular control: the attacks become more frequent and more intense and finally lead to death. In the cases observed in the Kogu and Busarasa-Mɔ:ge districts, the subjects could walk with the aid of sticks or with help of friends; there were involuntary twitchings, a feeling of abnormal coldness, dilation of the eyes which appeared to be glazed, and lack of control over limbs. Despite muscular difficulty in uttering words, they did not appear to be mentally affected, although cases inferring this have been recorded.

The established distinction between these two conditions, with their differing courses, and their clear ascription by the natives to different origins, is of great interest and importance. Equally important is the fact that the more serious, patently organic, condition, which corresponds with that described by Zigas and Gajdusek, is firmly embedded in the tradition and magic of the Fore people and may be reasonably assumed to have been present in the region for many years; although there is evidence to show that it does not take very long for an explanation in terms of sorcery to be built up around a new disease—for example, dysentery, which has been known in the area for only about ten years. Evidence to this effect was gathered by the Government Anthropologist, C. Julius, who in 1956 made a study of the "sorcery" angle of various diseases in the area, including kuru. Subsequently, at the beginning of 1957, tentative arrangements were made for the Walter and Eliza Hall Institute of Medical Research to cooperate in the investigation of kuru with officers of the Administrative Medical Service, of whom V. Zigas in particular had taken a great interest in the syndrome. The Hall Institute was, of course, particularly attracted to the investigation by the possibility accepted at that stage that kuru was a post-encephalitic manifestation. However, at this point a specially qualified American investigator, D. C. Gajdusek, came on the scene and the work was spread to include American laboratories. Some regret may be felt that work which originated and was developing in Australian hands should be diverted overseas, when it could have been done at least as effectively by Australian investigators. This feeling is natural enough. However, perhaps we should not be too sensitive about this, lest we be suspected of Chauvinism, for which, as Osler[1] has stated in one of his most trenchant essays, "there is little room . . . in medicine". The important thing is, by whatever means, to unravel the mystery of this devastating syndrome.

It is clear from Zigas and Gajdusek's paper that, despite the extensive and careful work that has been done, many fundamental facts about kuru remain obscure. The long list of negative findings from both clinical and laboratory investigation is a spur to further effort. The full clinical course of the condition is not recorded, if it has been observed. The termination of the disease is described in terms of the fatal complications associated with death in primitive surroundings; what the course of the disease would be under full hospital conditions can only be guessed at, and may, of course, be difficult to determine in practice. The results of thorough histological examination of post-mortem material will be awaited with great interest, as will the results of further studies of possible genetic and environmental factors. Attractive as it may seem at first sight, a genetic theory of causation for this syndrome raises its own difficulties, and the answer to the problem

[1] *Oceania*, 1952, 23: 40 (September).
[2] *Oceania*, 1954, 24: 206 (March).

[1] "Aequanimitas and Other Addresses", 1904: Lewis, London, page 305.

may yet lie in some environmental factor or factors such as diet. Be that as it may, Zigas and Gajdusek are to be congratulated on the work that they have so far done. It is to be hoped that all available resources will be marshalled to solve the vital outstanding problems of kuru.

Current Comment.

CARCINOMA OR PNEUMONIA?

UNSATISFACTORY as the treatment of carcinoma of the lung may be, there are very few physicians and probably no surgeons who are not anxious to differentiate the condition from inflammatory lesions at the earliest possible moment. There is a small group of cases in which the distinction is difficult or even impossible; D. O. Shields and his colleagues[1] have deliberately selected, on radiological grounds, 22 such cases (constituting about 7% of a series of cases of bronchial carcinoma) and analysed the associated features for comparison with a series of 62 cases of pneumonia. All the patients were over the age of forty years. The results may be stated in very general terms, for it is obvious that, however accurate they may be, they are applicable to the individual patient only in terms of probabilities. Cough and dyspnœa on exertion were common to both groups. Loss of weight seemed to be related more to the duration of symptoms than to the nature of the disease process; a history of previous pneumonia was present in most cases in both groups. An onset over a few days only was noted in 75% of cases of pneumonia and 25% of cases of carcinoma; the presence of symptoms for over a month was observed in the reverse proportions. Hæmoptysis occurred in a third of the cases of pneumonia and in two-thirds of those of carcinoma. Evidence of bronchial obstruction on physical examination tended to be commoner in the latter condition; the value of careful palpation of the neck for glandular metastases is not mentioned. Pyrexia of similar degree was found in both groups, but it persisted for more than three weeks in half the cases of carcinoma and in less than 10% of the pneumonia series. The same percentage of patients of each group produced more than 120 millilitres of sputum, but virtually nothing was gained by smelling it, culturing it or indeed inspecting it, except in the few patients with pneumonia who coughed up typical "rusty" phlegm. Transient eosinophilia was noted in a third of cases of pneumonia, but in none of those of carcinoma; but in other respects the hæmatological findings were similar. The radiological appearances were, of course, comparable owing to the method of selection of cases of carcinoma, but the point is made that tomography may reveal a hilar mass unsuspected on ordinary radiographs. The important question of the extent of radiological clearing in the two series of cases is not discussed as lucidly as one might wish; insufficient attention is paid to definition of the terms used, and one might reasonably have hoped for the inclusion of an observer error study to give a greater degree of clarity to the solution of a difficult problem. However, the authors conclude that, at the end of four weeks, 25% of patients with pneumonia had "a residual" of 25%. If satisfactory clearing is defined as 50% clearing, then at the end of four weeks this would have been attained by over 90% of the patients with pneumonia and by about 10% of those with carcinoma, both groups having been treated with antibiotics in the interim. This important finding is worth study by methods which would give greater statistical validity to the conclusions. Incidentally, some evidence was found to suggest that pneumonia takes longer to clear where it complicates bronchitis and emphysema.

Up to this point the management of the patient may well have been the responsibility of the general practitioner; but at this stage, if not before, bronchoscopy is indicated if any element of doubt as to the diagnosis persists. From the chart given by Shields and his coworkers it is not easy to give precise figures, but it would seem that bronchoscopy gave more or less positive evidence of carcinoma in considerably more than half the finally proven cases. "False negative" findings were recorded in 5% of cases of carcinoma, while some evidence to suggest malignancy was found in about 10% of patients with pneumonia, and this is the proportion of patients with this condition who were submitted to exploratory thoracotomy. As a result four lobectomies and two pneumonectomies were performed; one patient died, and three are permanently disabled. These results are mentioned not as an implied criticism, which would be wholly unjust on the evidence available, but to indicate the importance of taking every possible step to establish the diagnosis of pneumonia before having recourse to operation. There is, of course, a small group of patients with chronic localized suppuration for whom surgical treatment is indicated in any case; Shields and his colleagues rightly emphasize that differential diagnosis may be particularly difficult in this group.

It is of interest that no mention is made of clubbing of the fingers. Acquired clubbing, indicated notably by a "floating" nail in addition to alteration in contour, is commoner in carcinoma than in pneumonia, although it may occur in the presence of suppuration.

[1] *Am. Rev. Tuberc.*, 1957, 76: 47 (July).

WORLD EPIDEMIOLOGICAL AND VITAL STATISTICS.

THE World Health Organization publication, "Annual Epidemiological and Vital Statistics, 1954", is to hand.[1]

> The vital statistics and state of health of the world in 1954 are reflected in more than 580 pages of figures, collected in 109 tables. Through these conventional symbols, the figures, it is possible to give a picture of the population of each country, its growth and the illnesses from which it suffers, as well as of the extreme diversity of the conditions that exist—in short, to show what it is that the inhabitants of any part of the globe suffer and die from.
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> In addition to the usual sections on population and vital statistics, causes of death and cases of communicable disease, this new edition of the WHO yearbook contains a new part dealing with health personnel, the number and distribution of hospitals and the vaccinations of various types carried out in each country.
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> The yearbook is planned to fulfil a double purpose: (1) to supply basic documentation in the form of actual official figures, thus avoiding the need for long and sometimes futile searches (since part of this documentation is, in fact, unpublished, being communicated to WHO through special questionnaires); (2) to facilitate the immediate understanding of the data by a collection of specific mortality rates, referring, for example, to a group of countries, to some particular cause of death for a given age and sex. Particularly detailed information is given on tuberculosis, cancer, cardiovascular diseases, etc. A new table gives death rates by sex and age for the infective and parasitic diseases as a whole in 24 countries. These figures are remarkable, for they reveal how greatly health conditions vary in different parts of the world, so that the mortality from infective disease among infants may be twenty times higher in one country than it is in another. Study of the other tables shows why this is so.

So runs the official covering letter accompanying the publication, and there are indeed many tables of great interest to us. First we may note the tables of mortality rates from all causes and see that Australia holds a place with other countries enjoying the same material benefits of civilized life among the countries with a low mortality. However, the New Zealand rates are more favourable at almost every age, and so are the rates at ages one year to forty years of England and Wales, which is remarkable if we remember that some twenty years ago our rates at these ages were much more favourable than the English. The

[1] "Annual Epidemiological and Vital Statistics, 1954"; World Health Organization; 1957. Geneva: World Health Organization. Sydney: H. A. Goddard Pty. Ltd. 11" x 8½", pp. 620. Price: £2 10s.

great improvement in England and Wales is possibly due to the improved economic and educational status of the English industrial workers.

The death rates in Western Germany, given for each of the years since the war by age and sex, provide a striking commentary on the effects of the World War and the recovery. The infant mortality, for example, was 130 per thousand in 1946, but had fallen steadily to 50 per thousand in 1954. At ages 35 to 39 years the death rate for females was six per thousand in 1946, and then fell to two per thousand in 1954. The corresponding improvement in the mortality of males was even greater.

Detailed tables are given of infant mortality rates by cause and of the death rates at all ages by some of the leading causes. We may consider the death rates from accidents associated with automobiles. It is well known that many American high school boys drive themselves to school by automobile, and the ratio of automobiles to persons is the highest in the world. It is, therefore, a surprise to find that Australia has the highest death rates from automobile accidents of all countries in the world at ages up to forty years, and in those for older persons is second only to the United States. It is, perhaps, too much to expect an analysis by type of vehicle, but such an analysis might reveal that the motor-bicycle was of greater importance in Australia than in America.

Australia is favourably placed among countries with low tuberculosis rates. However, in 1954 there were more deaths from diphtheria in Australia than the combined totals for England, Norway, Sweden and New Zealand. In Sweden there were no deaths in 1954 from diphtheria. Whooping-cough was responsible for very few deaths in any of the Western countries. Meningitis still causes a number of deaths in many countries.

There are other comparative tables which will repay study. Perhaps it is appropriate to mention the stimulating effect that these tables have on the official statistics throughout the world. It is evident that some countries have made special tabulation, or alternatively have made efforts to get the information together sooner than has often been the custom. Their efforts, however, will have been very worth while, since workers in many specialized fields will now be able to make international comparisons of such conditions as diabetes, the infectious diseases, cancer, violence and the cardio-vascular diseases. These efforts will assist the public health worker to return to his old role of epidemiologist.

THE RETICULAR FORMATION OF THE BRAIN STEM.

THE Henderson Trust was established in 1832 for the advancement and diffusion of the science of phrenology. However, phrenology as conceived by Gall and Spurzheim, and supported by Henderson, fell into disrepute by the middle of the last century, and the trustees, while adhering to the spirit of the bequest, have latterly adopted a much wider interpretation of what constitutes "phrenology". Today, anything conceivably related to localization within the central nervous system in particular provides an appropriate theme. Thus the trustees have secured works from many notable scientists, some of which have become classics. The volume by Alf Brodal[1] just issued by the Trust may fairly be said to maintain the high standard set by its predecessors.

The reticular formation comprises a series of not very well defined nuclear groupings distributed in the pial reticulum, which surrounds and supports bundles of nerve fibres passing in various directions. This reticulum extends throughout the brain stem, including the diencephalon. (Incidentally, the title of the present volume is rather misleading, since the author excludes the diencephalon.) The formation was first described by neuroanatomists towards the end of the nineteenth century, but it has come into prominence only in the last twenty years or so, mainly through the work of neurophysiologists. The task of Professor Brodal and his school has been to try to determine the structure, distribution and connexions of the reticular nuclear groupings by the methods of descriptive and experimental anatomy, and to attempt a correlation with the claims of neurophysiologists. The work, as Brodal points out, is far from complete, but it does give a solid basis of fact upon which to assess physiological claims. The conclusion is that "fruitful progress will require that more attention be paid to the structural features than is usual in neurophysiological studies" and ". . . . in the absence of detailed anatomical information the interpretation of brain potentials is fraught with dangers and difficulties". This book is a useful corrective to the over-enthusiastic claims of current neurophysiology and will be welcomed by everyone concerned with the subject. The work is well produced and includes an extensive, but not exhaustive, bibliography.

[1] "The Reticular Formation of the Brain Stem, Anatomical Aspects and Functional Correlations", by Alf Brodal, M.D.; 1957. Edinburgh and London: Oliver and Boyd for The William Ramsay Henderson Trust. 9¾" × 7¼", pp. 96, with 32 illustrations (including five plates). Price: 21s. 9d.

TRUE SACCULATION OF THE PREGNANT UTERUS.

TRUE SACCULATION of the pregnant uterus is defined by Donald A. Dallas[1] as a ballooning out of a limited area of the uterine wall, the cavity of the sacculated area being connected with the cavity of the uterus by a narrow opening. True sacculation, as described, is not to be confused with sacculation of the incarcerated pregnant uterus, with temporary bulging of the uterine wall due to asymmetrical tone and contractions, or with marked thinning of the uterine wall in pregnancy following myomectomy, Cæsarean section or perforation of the uterus. Dallas reviews the meagre literature on the subject and reports two cases encountered in his practice. The first patient was a primigravid woman with a normal past history and normal pregnancy to within one month of term, when spontaneous labour commenced and a normal six-pound baby was delivered. Attempts to express the placenta were unsuccessful, although the uterus was contracted and bleeding was minimal. After a delay of 36 hours, manual removal of the placenta was attempted, but the placenta could not be located. The abdomen was then opened, and a thin-walled ballooned sac, the size of a grapefruit, was found on the right side of the uterus. This sac contained the placenta. The sac was incised, the placenta was removed and the incision was closed by three layers of sutures. Two years later the patient was delivered by Cæsarean section on account of a breech presentation. The baby and placenta were normal, and careful examination of the uterus showed no defect in its wall. The second patient was examined in October, 1954, at the age of 38 years, having a past obstetrical history of two abortions, a forceps delivery of a baby weighing eight pounds eight ounces and a normal delivery. The present pregnancy was normal, and the patient was delivered of a baby weighing nine pounds five ounces. Attempted expression of the placenta failed, and exploration of the uterus showed it to be empty, with the placenta lying in a sacculated pouch on the right side of the fundus. The placenta was separated from the pouch by digital manipulation and delivered without incident.

Dallas briefly summarizes nine cases of true sacculation of the uterus reported in the literature, and states that the ætiology of the condition is unknown. Three possible ætiological factors have been suggested: (i) the implantation of the fertilized ovum in a uterine diverticulum; (ii) the abnormal penetration of the uterine wall by the trophoblast; (iii) the development of the ovum in a defect in the uterine wall caused by previous pregnancy or instrumentation. Dallas is of the opinion that true sacculation is due to a marked loss of tone of a small area of myometrium. The diagnosis of sacculation is difficult clinically, and treatment involves emptying the sac by whatever means is feasible. The condition then corrects itself, with complete restoration of the uterus to its original condition.

[1] *West. J. Surg.*, May-June, 1957.

Abstracts from Medical Literature.

BACTERIOLOGY AND IMMUNOLOGY.

Newcastle Disease Infection in Chicks.

M. K. NADEL, H. C. FRYER AND A. EISENSTARK (*J. Infect. Dis.*, January-February, 1957) attempted to estimate the probable minimum numbers of Newcastle disease virus particles required to initiate infection in chick embryos and baby chicks. The results of inoculation of serial dilutions into the allantoic cavity of 10 eggs, 10 days old, and of intracerebral inoculation into 40 chicks, after careful statistical inspection, suggested that conclusions drawn from experiments based on such numbers would be likely to produce valid results. On the assumption that there is a sufficient number of particles in the inoculum to produce infection, and that there must be at least an equivalent number of loci on the surface of the embryo or on the chick brain cells, the evidence suggests that either one virus particle in the inoculum, or a successful attachment to one locus, in the embryonated egg, is sufficient to kill the embryo, or in the case of cerebral inoculation in the chick, two particles attacking two to four loci in the brain.

Propagation of Poliomyelitis Virus in Rabbit Embryo Kidney.

F. W. SHEFFIELD AND G. M. CHURCHER (*Brit. J. Exper. Path.*, April, 1957) record the serial propagation of poliomyelitis viruses in cells derived from rabbit embryo kidney. The virus cultures were maintained in HeLa cells, passed in embryo rabbit kidney cells. These cells were propagated in a medium of normal rabbit serum, tryptic broth and lact-albumin hydrolysate, and the resultant tissue cultures were titred to estimate the yield of virus in them. The results obtained show the production of high titre pools in this tissue derived from embryo rabbit kidney, and the authors comment on the ease of production of antigen for serological work.

Virulent and Avirulent Virus in Tissue Culture.

F. B. BANG AND A. WARWICK (*J. Path. & Bact.*, April, 1957) have studied the effect of an avirulent and a virulent strain of Newcastle virus on cells in tissue culture. This followed the experiments on the two strains in living embryo allantoic cells *in situ*, in which it appeared that the avirulent strain multiplied at the cell surface and was released into the allantoic fluid, whereas the virulent strain produced destruction throughout the cell and was released as the cell broke up. In these experiments the authors used chicken white blood cells, or embryo fibroblasts or Walker rat carcinoma 256, and followed the cultures up to 80 days after infection with the two strains of virus in roller tubes. The results of a large series of cultures showed that the virulent strain of virus rapidly increased in virus titre in the fluid and destroyed all three types of cells, and the culture showed no living cells in five days after inoculation. The avirulent strain, however, while destroying the cells, allowed regeneration of cells even when the original inoculation was large. The process was slower in cultures inoculated with the avirulent strain, and the amount of virus influenced the rate of tissue-cell destruction in these fibroblast cultures. The avirulent virus grew poorly in macrophage cultures, and some were observed for 80 days, with survival of virus and minimal damage to culture cells during this time. Tests were performed to show the rate of absorption of virus from inoculated fluid. About 80% of virus was absorbed within half an hour.

Streptococcal Nucleotidase.

A. B. BERNHEIMER, P. D. LAZARIDES AND A. T. WILSON (*J. Exper. Med.*, July, 1957) examined the development of diphosphopyridine nucleotidase (DPN) as an extracellular product of streptococcal growth and its possible relationship to leucotoxicity. The recent examination of protein as an extracellular growth product of hæmolytic streptococci showed that it could catalyse specifically the cleavage of DPN at the nicotinamide-ribose linkage. The authors searched for the substance in culture supernates of 45 species of bacteria and yeasts without any success. They then tested a large number of species of streptococci, and found that those belonging to groups A, C and B covered the range of groups. Investigation of 41 strains which appeared to have been isolated from patients suffering from acute glomerulonephritis showed the enzyme activity to be present in 39. There is an association between the enzyme and the capacity to kill leucocytes.

Cryptococcus Neoformans.

C. J. KAO AND J. SCHWARZ (*Am. J. Clin. Path.*, June, 1957) record the isolation of *Cryptococcus neoformans* from pigeon nests and offer comment on the identification of virulent cryptococci. They collected nests used by the birds, emulsified fæcal samples, tested the 41 strains they obtained in a basic medium and a series of carbohydrate media, and tested their virulence in mice and hamsters. The results varied within the group, and the organisms were usually similar to the strain of *C. neoformans* of the American type collection. In the experimental animals, usually the organisms were recovered from brain and liver. The 17 strains tested caused death of the animals.

Evaluation of Poliomyelitis Vaccine.

A. J. BEALE, A. BALASUBRAMANIAN, D. L. MCLEOD, N. DAVIS, W. STACKIW, G. A. MCNAUGHTON AND A. J. RHODES (*Canad. J. Pub. Health*, June, 1957) have carried out laboratory studies in connexion with the evaluation of poliomyelitis vaccine in Toronto in 1955. During the progress of a large-scale vaccination scheme, virological studies were made on 13 vaccinated children who suffered from an illness which might otherwise have suggested poliomyelitis as the diagnosis. Attempts to isolate poliomyelitis virus from the stools failed in every instance, but four isolations of Echo virus and one of Coxsackie virus were made. One of the children later had an illness associated with paralysis, another without paralysis. In a further group of 14 unvaccinated children as controls, a single isolation of poliomyelitis virus was made, and in nine cases Echo virus was isolated. The authors discuss the possibility of a clinical syndrome associated with Echo virus and comment on the association of Echo virus with aseptic meningitis in the State of New York. Tissue culture methods were thought to be highly sensitive for primary isolation of virus, since poliomyelitis virus was recovered from 12 of a group of 13 paralysed patients. The effect of the vaccine used in 1955 could not be demonstrated to have a prophylactic effect. However, in this laboratory during the summer and autumn of that year, all isolations of poliomyelitis virus came from unvaccinated children.

Adenoviruses from Military Recruits in the Netherlands.

J. VAN DER VEEN AND G. KOK (*Am. J. Hyg.*, March, 1957) attempted to isolate and type adenoviruses in military recruits suffering from acute respiratory disease in the Netherlands. Throat washings were obtained, treated with penicillin and streptomycin and cultivated in HeLa cells, and the cultures were observed for periods up to four weeks. Cultures showing cytopathogenic changes were harvested and passed. Neutralizing sera were prepared in rabbits after three injections of antigen. At least two samples of serum were obtained from each subject. Complement fixation tests and antistreptolysin O titrations were carried out, and tests were made for cold agglutinins. Of 25 patients tested, nine yielded cytopathogenic agents which could be passed. The new agents were serologically distinct from adenoviruses 1 to 7 of Huebner, but their antisera were mutually neutralized, and serum from many contact patients in whom no virus isolations had been made contained neutralizing antibodies to the prevalent type.

The Inactivation of Type III Adenovirus in Water by Chlorine.

N. R. CLARKE, R. E. STEVENSON AND P. W. KABLER (*Am. J. Hyg.*, November, 1956) made a study of the inactivation of purified Type III adenovirus in water by chlorine, following reports of epidemics of pharyngo-conjunctival fever. They used a HeLa tissue culture supernate as a source of virus, after purification by centrifugation, freezing and thawing in order to eliminate the major portion of the chlorine-demand material. Aliquots of this purified material were chlorinated, the excess chlorine was neutralized by the addition of 20% chicken serum in Hank's balanced salt solution, and then the aliquots were tested for viability in tissue cultures of HeLa cells. The results were compared with inactivation times for *Escherichia coli*, *Salmonella typhosa*, *Entamœba histolytica* cysts and *Bacillus anthracis* spores. The amount of chlorine required to inactivate the purified adenovirus was the same as for *E. coli*, which is used as the standard in purification of

public water supplies, so that such places as public baths are probably free from adenovirus when they are also free from *E. coli*. They quote another author who comments on the association of conjunctivitis with swimming, and suggest that this may predispose to its development by a naturally acquired virus.

Cross Infection by Pneumococci.

A. T. DRIMMIE (*Scottish M.J.*, July, 1957) records cross infection in a children's ward with the pneumococcus as a tracer organism. She made serial swabbings from the anterior and posterior parts of the nose and the throat of children in a ward housing patients with respiratory infections, and also of the hospital staff attending them. The pneumococci were typed, and a rough count of associated *Staphylococcus pyogenes* and *Streptococcus hæmolyticus* was made. While the staphylococcus was the most frequently transferred organism from staff to patients, pneumococci predominated in the first swab from patients and were frequently transferred to the staff. The typing of the pneumococci permitted the detection of a given pneumococcus from the original carrier to patients in the adjoining bed, although in some instances it appeared in another section of the ward. It appeared that hæmolytic streptococci were similarly distributed, and that the likeliest method of transmission was by droplet-infected dust. Very little evidence of clinical disturbances appeared amongst the patients concerned. The transmission of *Staph. aureus*, however, appeared to be from infected members of the staff, although it was present in the floor dust on every occasion on which samples were examined.

HYGIENE.

Distribution of Two Mercury Compounds in Rabbits after a Single Subcutaneous Injection.

L. FRIEBERG, E. ODEBLAD AND S. FORSSMAN (*Arch. Indust. Health*, August, 1957) investigated in rabbits the distribution of mercuric chloride and phenylmercuric acetate (labelled with Hg^{203}) in the kidneys, liver, spleen and brain, by scintillation counting one, six and 40 days after a single subcutaneous injection, and by autoradiography after one and six days. By far the highest concentrations of mercury were found in the kidneys. Next in order were the liver and the spleen. The readings in the cerebrum, cerebellum and brain stem, calculated per gramme of wet weight, were less than 1% of the corresponding renal levels. No significant difference was demonstrated between the various parts of the brain. Forty days after the injection, the amount of mercury in the organs was less than 20% of the readings after one day. However, the radioactivity in kidney tissue after injection of inorganic mercury did not diminish so rapidly. Otherwise, there was no significant difference between the experiments with organic and those with inorganic mercury. In the kidneys almost all the mercury collected in the cortex. There was no clear difference between specimens taken one and six days after injection or between organic and inorganic mercury. In the liver there was pronounced localization of mercury to the region close to the portal veins six days after injection of inorganic mercury. This was only faintly discernible in the one-day autoradiographs. Organic mercury produced a more even distribution pattern. All spleen specimens showed higher density for the red pulp than for the white pulp. The cerebrum, cerebellum and brain stem showed no activity on autoradiographs.

Health Hazards from Chlorine Dioxide.

J. GLOEMME AND K. LUNDGREN (*Arch. Indust. Health*, August, 1957) report the results of clinical and industrial hygiene investigations into exposure to chlorine dioxide at a cellulose factory. The use of this substance as a bleaching agent is increasing in the paper pulp industry and in textile and oil industries. It is also used in the treatment of flour and water. Technical investigations showed low concentrations under ordinary working conditions. Higher concentrations occurred in connexion with technical faults—*e.g.*, leakage. Severe troubles arose only in connexion with the latter. Symptoms and signs were irritation of the respiratory organs and the eyes, and in certain cases of the gastro-intestinal tract also. No indications of cerebral effect could be shown. Extensive investigations, comprising radiological examination of the sinuses, lungs, and heart, bronchoscopic examination with biopsy of bronchial mucous membrane, spirometry and functional tests, showed the occurrence of slight bronchitis in seven of 12 workers exposed to chlorine dioxide. The possibility of slight emphysema in connexion with this is discussed. The investigation does not allow of a closer estimation of a threshold limit for chlorine dioxide. From the clinical histories it seems that the acute exposures probably play the most important part from a medical viewpoint.

The Biological Action of Submicron Amorphous Silica Dust.

G. SCHEPERS, T. DURKAN, A. DELAHANT, F. CREEDON AND A. REDLIN (*Arch. Indust. Health*, August, 1957) review the problems created by the introduction and increasing commercial use of particulate synthetic submicron amorphous silica. This substance is composed of almost 100% silicon dioxide. Some of its uses are as a filler for rubber, paint and paper, to dilute insecticides, as a grease thickener, and as a component of various ointments, cosmetics, polishes, adhesives and ink. An outline of a comprehensive series of tests to evaluate the toxicity of such a dust is recorded, and the effects on rats after inhalation are described. When exposed to an average aerosol concentration of 1·5 milligramme per cubic foot of air, the majority of the rats died from pulmonary vascular obstruction coupled with pulmonary insufficiency due to emphysema. The development of pulmonary lesions was accompanied by the progressive concentration of silica and increase of inorganic substances in the lung. On removal of the rats from the dust environment after six months of exposure, the majority rapidly recovered; the silica was largely eliminated from the lung tissue, and the cellular nodules, perivascular infiltrations and emphysema were almost completely resolved. The prevalence of infective and inflammatory changes to which the rat lung is generally prone appeared to be considerably reduced in the series of experimental animals exposed.

Response of Vaccinated Chimpanzees to Poliomyelitis Infection.

H. A. HOWE, W. O'LEARY, W. BENDER, M. KIEL AND A. FONTANELLA (*Am. J. Pub. Health*, July, 1957) observed the excretion of Type I poliomyelitis virus from the alimentary canals of seven vaccinated and seven control chimpanzees following oral challenge with this virus. It was found that the presence of serum antibody induced by commercial vaccines clearly limited the duration and amplitude (titre) of alimentary infection with type I poliomyelitis virus in chimpanzees. This animal appears to react to poliomyelitis virus in a manner identical with that observed in man. The authors consider that the observations described suggest that mass vaccination will appreciably affect the epidemiology of poliomyelitis, at least in certain segments of the population. The groups most likely to show a reduction in the risk of exposure (and consequent loss of booster effects through natural channels) are the upper income brackets of the temperate zones, and sparse, remote populations all over the world.

Natural Occurrence of Hæmolytic Streptococci in Normal School Children.

R. W. QUINN, F. W. DENNY AND H. D. RILEY (*Am. J. Pub. Health*, August, 1957) give the results of an investigation into the natural occurrence of hæmolytic streptococci in non-epidemic periods in civilian populations. Throat cultures were prepared from third and fourth grade children in three different socio-economic areas. Cultures were prepared every week during the study year 1953–1954, and every two weeks in 1954–1955. Hæmolytic streptococci were classified according to serological groups and types and certain epidemiological correlations were made. The carrier rates were highest in the best socio-economic area, reaching 60% in 1953–1954 and 42% in 1954–1955. The highest figures in the middle and lower socio-economic areas in 1953–1954 and 1954–1955 were 45% and 26%, and 41% and 30%, respectively. Cumulative percentages of children with positive throat cultures were 88%, 75% and 82% for the same areas in the same order respectively, in 1953–1954, and approximately the same for all three (about 60%) in 1954–1955. Group A streptococci composed 83·7% of all streptococci recovered, group C (4·7%) and group G (9·8%) accounting for most of the other hæmolytic streptococci. Approximately 52% of all the group A strains were typeable. The typeable strains isolated most frequently were I, VI and XII. Types changed in each area in each study year. The degree of crowding in the home and school and meteorological conditions did not seem to influence the carrier rates directly.

Brush Up Your Medicine.

EYE INJURIES IN INDUSTRY: THEIR MANAGEMENT AND PREVENTION.

THE subject of eye injuries in industry is one of considerable importance, whether it is viewed from the scientific or the economic aspect, because there is probably no other department of industrial medicine in which relatively trivial forms of trauma may cause such prolonged disability and loss of production-time. Moreover, with the decentralization of industry many more medical officers are being required to assume responsibility for the treatment of eye injuries, and especially is this so in country areas where an ophthalmologist may not be readily available.

As an indication of the extent of the problem, it is worth noting the following figures supplied by the medical officer of one of the major heavy industries in New South Wales employing approximately 10,000 men. During the year 1954, the average number of new eye casualties presenting to the ambulance room was 75 per day. Not all of these were "lost-time" cases; but of the actual "lost-time" accidents at the works, 10% were due to eye injuries alone. This is a high percentage.

By courtesy of Dr. M. Finlayson, Director of Medical Services, New South Wales Government Railways, the following information is supplied from the Railway Department for the same period:

Total number of staff	55,600
Total number of lost-time eye injuries	1120
Eye injuries as percentage of total	11·1%
Total cost of eye injuries for twelve months	£14,565

Further weight is given to all the foregoing figures when it is realized that 90% of eye injuries are preventible (Duke-Elder, 1954).

Within the scope of this paper it is not possible to deal with all forms of eye injury and their detailed treatment; but it is proposed to discuss the more common forms of industrial eye injury and to outline the treatment, together with the indications for obtaining consultant advice when this is needed.

GENERAL PRINCIPLES.

The medical officer who intends to treat eye injuries will be well advised to adopt a routine method from the beginning. By doing this, he will save much time and minimize errors in observation. The principles may be very simply stated as follows:

1. Take a careful history. This does not mean that a man with a painful lachrymating eye should be submitted to lengthy interrogation; but a few pertinent questions will establish at once the nature of the trauma and indicate the probable type of injury (*vide infra*.) The patient should also be questioned as to any previous eye disease or injury, and whether he needs to wear glasses constantly.

2. Carry out a systematic examination. It should be remembered that an injured eye is often extremely painful, and the associated blepharospasm and lachrymation may make accurate examination impossible. Therefore the immediate instillation of "Decicain" drops (0·5%) will give relief and also secure the patient's confidence — a not unimportant consideration. With the patient rendered comfortable, careful inspection is carried out under a bright light with the aid of a binocular loupe and condensing lens. The inspection must be thorough, and yet need occupy but a few moments. Commencing with the lids, including the lachrymal puncta, the examiner proceeds rapidly to the fornices, always everting the upper as well as the lower lids. Next he inspects the cornea (noting old scars and a pterygium if present), then the anterior chamber and iris, observing the size and mobility of the pupil. The ocular tension is then taken with the fingers. Next the visual acuity of each eye is recorded with a Snellen's test type at 20 feet; a single-letter test card will suffice for this purpose. (This simple test takes but a few seconds and should never be omitted. Its adoption as a routine may save many awkward explanations later.) With an ophthalmoscope the fundus should be inspected to exclude any gross intraocular trouble. If the eye is irritable, yet no obvious corneal lesion or foreign body is seen, the instillation of fluorescein drops (2%) will often reveal an abrasion or small foreign body. In any event, the routine use of fluorescein is advisable. Further points to remember are that both eyes must be examined, and that attention must not be allowed to be focused on some obvious lesion at one point only. (The corneal abrasion which it is proposed to treat may be the result of a foreign body beneath the upper eyelid.) Finally, a simple diagram in the notes will prove extremely valuable for quick reference later.

The more common types of injury will now be discussed in some detail.

INJURIES FROM FLYING MISSILES.

Corneal Foreign Bodies.

Foreign bodies in the cornea constitute the commonest of all eye injuries and for this very reason are often treated in a somewhat cavalier fashion at the first-aid post. It should be realized that quite a small foreign body in the pupillary area may be followed by ulceration and scarring, which may result in some permanent loss of vision. It should be remembered, too, that the removal (with minimal trauma) of a deep-seated foreign body is a delicate and skilful surgical procedure, facility at which is acquired only by practice.

The patient should be lying down (or have his head supported as in a dental chair), and the eye must be completely anæsthetized with 0·5% "Decicain" drops. Other essentials are a binocular loupe, a good light and a sharp discission needle. (This is preferable to a spud.) A speculum is unnecessary, as the lids may readily be separated and the globe steadied by the fingers of one hand. If the operator is ambidextrous, this will prove an advantage. The foreign body must be removed completely and no rust or scale allowed to remain. This is sometimes difficult, and the operation may have to be repeated the next day, when the slough will separate more easily. (A monocular loupe will be needed for minute inspection, and it will be very helpful if facility is acquired in the use of this small instrument.)

A mydriatic is then instilled (*vide infra*). This is followed by antiseptic drops, and the eye is covered by a firm pad. The drops commonly used are sulphacetamide sodium (20%) or sulphafurazole (4%); but the possibility of sensitivity must be kept in mind, and if there is a history of allergy to these drugs, then a substitute such as "Metaphen" (one in 2500) must be employed.

The question of mydriatics is really very simple. Any corneal injury will have an associated congestion of the ciliary vessels with some engorgement of the iris. The instillation of a mydriatic is therefore necessary on the principle that a congested part is more comfortable when at rest. The following is a very useful rule. The pupil must be kept dilated just so long as the eye is red, but no longer. If atropine is used, the pupil will be dilated and the vision blurred for up to 10 days (because this drug is also a cycloplegic), during which time it will probably be necessary for the man to remain off work. Therefore, if the foreign body is not very deep and the eye is not very red, use homatropine hydrobromide drops (2%) and repeat the instillation daily or more frequently as required. This will secure a minimum period of disability from the mydriatic. In elderly patients the possibility of glaucoma must be kept in mind when any mydriatic is used.

The after-treatment consists in hot bathings and the use of antiseptic drops every four hours, the pad being replaced after each treatment. The patient is told to report the next day, and if the eye is comfortable and the ulcer healed (no stain with fluorescein), the pad may be left off; but if the eye is not perfectly well, the treatment should be continued and the eye kept covered. If the eye is still red and irritable after two or three days, the patient should be referred to a consultant, as complications have probably arisen.

Two Special Conditions.

Seed Husk Ulcer.—In agricultural or grain workers, a small seed husk may blow into the eye and adhere to the cornea by suction. Being transparent, the husk is easily missed on casual inspection and may be mistaken for an indolent form of corneal ulceration. Removal of the offending cause by a discission needle under "Decicain" anæsthesia will naturally be followed by rapid recovery.

Dendritic Ulcer.—Dendritic ulcer is an herpetic disease of the cornea due to a specific virus infection, and staining with fluorescein presents a typical finely-branched pattern which is diagnostic. Attention is drawn to the condition because, although it is not normally regarded as being of traumatic origin, cases occur in which a history of recent injury is given, and under certain circumstances the trauma may be admissible in law as an exciting cause. The importance of this lies in the fact that the ulceration is apt

to recur spontaneously (or from apparently trivial causes), and if the pupillary area is involved the resulting scar may be of sufficient density to cause an appreciable loss of vision. Further, the condition is often extremely resistant to treatment, and weeks (or sometimes months) may elapse before healing finally occurs and the patient is considered fit for work. An early ophthalmological opinion is therefore essential in order to determine where the liability lies in any particular case.

Deep Corneal Foreign Bodies.

Deep corneal foreign body injuries are usually due to a sharp piece of steel penetrating the deeper layers of the cornea, and the wound is often valvular in type. The removal of such foreign bodies may be extremely difficult, and care is necessary to ensure that the foreign body is not pushed through into the anterior chamber. After antiseptic drops have been instilled and a firm pad has been applied the patients are best referred to a consultant.

Intraocular Foreign Bodies.

If the foreign body is large enough and travels with sufficient velocity, it will penetrate the globe, either remaining within the eyeball or passing through to the orbit. In many cases the diagnosis is obvious; but in some instances it is impossible to be sure, and the greatest care is necessary. The commonest cause is a "chipping" injury (*e.g.*, hammer and chisel.) If a man in this occupation gives a history of something striking his eye, he should be presumed to have an intraocular foreign body until the injury is proved otherwise; more particularly is this so if there is evidence of trauma to the globe, yet no foreign body is visible externally. In some instances one sees a tell-tale subconjunctival hæmorrhage or a corneal wound, an iris tear and possibly hæmorrhage in the vitreous, although cases do occur in which there is very little intraocular disturbance and no interference with vision, and it may even be difficult to convince the man of the serious nature of the injury.

An X-ray examination should be made; but it must be remembered that a negative X-ray finding is not always conclusive, and all these patients should be referred for an ophthalmologist's opinion since, if a foreign body is present, its retention will set up inflammatory changes and almost inevitably lead to loss of the eye.

INJURIES BY SHARP INSTRUMENTS.

Wounds of the Lids.

General surgical principles apply in wounds of the lids as in any other region. The wound must be carefully explored, its extent determined and any foreign matter removed before it is sutured. Two conditions will require special care. If the lid margin is involved, very careful suturing of the tarsal plate is necessary to avoid notching. Secondly, if the wound is medial to the lachrymal punctum, it is almost certain that the canaliculus has been severed, and if this is not successfully repaired, a persistent watering (epiphora) is likely to result. These patients should be referred to a consultant.

In all cases of lid injury, careful examination of the globe is necessary. A case is recalled (it did not occur in this country) in which a medical student, wearing glasses, bumped into a hospital door, his upper lid being cut by a splinter of glass. The wound was sutured by his friend the casualty surgeon. Some weeks later he consulted an ophthalmic surgeon because of blurred vision, and examination revealed a perforating wound of the sclera, with a subconjunctival iris prolapse. The eye was saved, but there was a permanent visual defect.

Wounds of the Conjunctiva.

The conjunctiva is a highly vascular elastic membrane which heals rapidly, and small wounds should not need suturing. If the wound is large or irregular, then suturing is necessary. But in all cases careful exploration is required to remove any debris, and to exclude involvement of deeper structures such as Tenon's capsule, ocular muscle insertions and sclera. When there is doubt, the patient should be referred to a consultant.

Wounds of the Globe.

Wounds of the globe occur with or without prolapse of intraocular contents. They are, of course, all serious. The immediate treatment is the instillation of antiseptic drops, the application of a sterile pad and bandage and the intramuscular injection of penicillin, after which the patient is sent to an ophthalmic surgeon for urgent treatment.

INJURIES BY BLUNT INSTRUMENTS.

Depending on the severity of the trauma, all forms of injury may occur, from simple bruising of the lids and orbital margins to severe intraocular damage (*e.g.*, dislocation of the lens, intraocular hæmorrhage or retinal detachment.) It is important to remember that a serious intraocular lesion may be masked by a simple "black eye", and in any but the minor forms of contusion it is wise to refer the patient to an ophthalmologist, especially if there is any disturbance of sight.

A fracture or hæmatoma of the orbital margin in the region of the oblique muscles may cause diplopia. If it is slight, this may not be described as double vision, the patient merely complaining of ocular discomfort. A rapid confirmatory test is to cover the good eye, when the symptoms will be relieved if true binocular diplopia is present. The condition is worth remembering as a genuine cause of disability, and if it is suspected, a further opinion should be sought.

INJURIES BY MOLTEN METAL.

Injuries by molten metal are common in the steel and allied industries, and if they are severe they may bring serious consequences. The metal solidifies and adheres to the tissues at the point of impact, being particularly likely to lodge at the inner canthus, where it remains until picked out. The degree of damage depends, of course, on the area involved; but even small particles may cause serious trouble if they are in the region of the punctum. In such cases the punctum is often completely invisible, being obliterated by slough and œdema. If the punctum is not located and kept dilated from an early stage, permanent occlusion from scarring is likely, and if (as is very often the case) the lower punctum is involved, a persistent epiphora will result. Not only is this a source of constant discomfort, but infection may readily be introduced through repeated wiping of the eye with a soiled handkerchief or dirty hand. Therefore, if the puncta are not easily discernible within two days, it is necessary to send the patient to a consultant. The routine treatment is frequent cleansing of the eye, the application of antiseptic ointment (*e.g.*, "Aureomycin" ointment, 1%) every four hours and keeping the eye covered.

Involvement of the fornices and bulbar conjunctiva is very likely to result in adhesions between the globe and lids (symblepharon.) It should be stated here that not all adhesions are preventible; but many burn injuries are found to be considerably worse after twenty-four hours, and it is advisable to refer the patients to a consultant at the outset. It should be remembered that all these patients may have an associated corneal burn, the extent of which will be determined by the instillation of fluorescein drops (2%.) The immediate treatment is the application of antiseptic ointment followed by a pad and bandage.

CHEMICAL INJURIES.

Severe damage may result from chemicals, and particularly from the stronger acids and alkalis. Special mention must be made of the effects of lime, of ammonia and of sulphur dioxide (refrigerators), as in all these instances the chemical penetrates deeply and may be absorbed into the intraocular fluids, causing prolonged disability and in some cases loss of the eye.

The appropriate antidote is not always at hand, and the most effective immediate treatment is copious and prolonged irrigation with tap-water. As with molten metal injuries, the medical officer will instil "Decicain" to relieve pain and fluorescein to determine the extent of the corneal damage, a general deep haziness of the cornea being a particularly bad sign.

All traces of chemical should be removed, and in the case of lime burns the particles of lime must be patiently picked out of the fornices with fine forceps. As with molten metal, adhesions are especially apt to form, and corneal complications are common. It is therefore advisable to refer most patients to a consultant at the outset after instilling antiseptic ointment and applying a pad.

NOXIOUS GASES AND FUMES.

Noxious gases and fumes may set up acute or chronic irritation of the conjunctiva and cornea; but in most cases the hazard is known, and adequate protective measures are taken by the industry concerned. Sporadic cases, however, do occur, and the condition is worth keeping in mind, although it is important before making a final diagnosis to make sure that the trouble is not of infective origin.

EXPLOSION INJURIES.

Explosion injuries are fortunately not very common, but they do occur, more particularly in the coal-mining industry. The eye condition may be only portion of a more generalized injury and is therefore apt to be overlooked.

Varying degrees of severity are encountered, from multiple foreign bodies in the lids, conjunctiva and cornea to perforation of the globe itself.

The immediate treatment is irrigation of the conjunctival sac with normal saline to remove all debris, followed by the regular use of antiseptic drops and an eye pad. Many of the corneal foreign bodies extrude themselves in the course of the next few days; but the extent of the injury is often in doubt in the early stages, and the opinion of a consultant should be sought as soon as possible.

"FLASH" INJURIES.

"Flash" injuries are common in the welding trade, and while they are not serious in themselves, certain points need emphasizing. In my experience the welder himself usually escapes injury, being protected by his goggles, whereas his assistant may fail to look away as the arc is struck. The features are the latent period of some hours before the onset of symptoms and the fact that both eyes are almost invariably involved. The patient complains that the eyes feel full of sand, and there is much lachrymation and photophobia. Recovery is rapid and is usually almost complete in twenty-four hours. If it is delayed longer, some other cause should be sought. The use of "Neo-Synephrine" drops (1%) followed by liquid paraffin will give relief.

Caution should be exercised when a man reports with a "flash injury" confined to one eye only. Careful examination will almost always reveal a corneal foreign body as the real cause of the trouble.

PREVENTION.

This section might well be the subject of a paper in itself, and some general observations only will be made. As has already been stated, it has been estimated that 90% of eye injuries are preventible, and this aspect has already engaged the attention of both industrial medical officers and ophthalmologists (Tostevin, 1947).

Much can be accomplished by positive measures (Minton, 1949), such as the wearing of goggles, and the use of face masks fitted to the forehead and special screens attached to machines; but it should be clearly realized that, while in theory complete eye protection is possible, the practical application is a different matter. Goggles, for example, become dirty and fogged, especially in hot climates, screens and guards become pitted and dusty, causing interference with vision, and added to this there was often in the past a casual attitude on the part of the worker himself. In this regard there is now an increasing awareness of the need for more eye protection in industry, and many workers are far more "eye-conscious" than was the case 10 or 15 years ago.

More recently, in some sections of Australian industry a further advance has been made by the institution of a "corrective-protective" programme based on similar methods successfully employed on a wide scale in America (Holmes, 1956). As part of this plan, the industrial medical officer, using a special simple diagnostic instrument, is able to carry out a rapid mass survey of the visual efficiency of all the workers under his care, those with visual defects or ocular disease being immediately referred to an ophthalmic surgeon for the appropriate treatment. This is an example of preventive medicine at a practical level, and its value to industry lies essentially in the fact that the responsibility is shared jointly by both management and workers.

CONCLUSION.

The eyes of the worker are the finest precision instruments in his possession, and it is his duty to care for them as such. If injury should occur, it is equally the duty of the medical officer to ensure their restoration to maximum efficiency with the least possible delay.

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Clinico-Pathological Conferences.

A CONFERENCE AT SYDNEY HOSPITAL.

A CLINICO-PATHOLOGICAL CONFERENCE was held at Sydney Hospital on July 16, 1957; DR. W. L. CALOV, honorary consultant physician, was in the chair. The principal speaker was DR. N. ROSE, the medical superintendent of the hospital.

Clinical History.

The following clinical history, from the Sydney Hospital files of nearly 40 years ago, was presented.

A labourer, aged 37 years, had suffered from gonorrhœa at the age of 12 years and from syphilis at the age of 25 years. He had had no other illnesses. He was proceeding to work when he was seized with severe pain in the "stomach"; he indicated the left and upper part of the abdomen and the left lumbar region as the site of the pain. He had not vomited and the bowels had been well opened with aperients. He was admitted to hospital about 30 hours after the pain began.

On examination of the patient, his temperature was 102° F., his pulse rate was 102 per minute, and his respirations numbered 38 per minute. There was no jaundice. There was acute tenderness on pressure immediately below the left costal margin and over the upper part of the left rectus muscle. Moderate abdominal distension and marked rigidity of the muscles of the upper part of the abdomen, particularly the left rectus, were also present. Liver dullness was absent. The white cells numbered 24,800 per cubic millimetre of blood, 90% being neutrophils.

Clinical Discussion.

DR. W. L. CALOV: Tonight we have the seventh clinico-pathological conference of the year, and the speaker is Dr. Norman Rose. Having read the history, I think it must have been prepared by his enemy, and no one can say that there is a maze of detail in it. To do what he can with these meagre facts I call on Dr. Rose to open the discussion.

DR. N. H. ROSE: Dr. Calov, ladies and gentlemen. I feel that those responsible for the preparation of this case merit some thanks for its brevity and apparent simplicity.

The history of an acute upper abdominal catastrophe and the signs of peritoneal irritation with apparent free gas in the peritoneal cavity suggest to me a diagnosis of ruptured hollow viscus, possibly the stomach. However, three years of association with clinico-pathological conferences warn me that this diagnosis is probably incorrect, and that I had better search for, or exclude, some more bizarre diagnoses that could account for the clinical picture described to us in these 14 lines.

Let me discuss, first, certain signs and symptoms that I consider important. This plot is set in the period of the latter part of the first World War, and I am confirmed in these suspicions by the presence here of Dr. George Bell. The main actor, obviously a remarkably precocious young man, exposed himself to the risk of venereal infection certainly on, and possibly before, his thirteenth year. His Neisserian infection was acquired in the eighteen-nineties, and had been treated no doubt most vigorously, probably with potassium permanganate or other irrigations, oil of sandalwood, and other of those quaint old medicines used at the time, and with prostatic massage and urethral sounds. It is interesting to note that the syphilitic infection was acquired about the year 1905, when the spirochæte was first identified as the cause of syphilis, and it was before Ehrlich in 1909 at his 606th attempt produced the organic arsenical called salvarsan. Therefore, at the time of this patient's admission to hospital, it may be assumed that he still harboured the wily spirochæte, and possibly also his prostate still provided a home for the gonococcus or its friends.

Frequently a careful study of the presenting symptoms pays handsome dividends by guiding one to a correct diagnosis. Despite the brevity of this history, I think every word may be important. I would like you to note that the onset of the pain was severe and was apparently sudden, and that it was in the upper part of the abdomen, below the left ribs and going around to the left lumbar region. This situation is such that it may be of interest, not only to general surgeons, but also to physicians, and also perhaps to Dr. Keith Kirkland and his urological colleagues whom I see in the audience.

Since many conditions may present themselves in this way, and since my main task is to enumerate the possi-

bilities before coming to a diagnosis, I would like to mention in some anatomical order the parts that may be involved and the not uncommon diseases that may affect them.

In considering first the alimentary system, we have to consider perforation due to ulcer, carcinoma and foreign body of the lower part of the œsophagus, stomach, duodenum and small and large bowel. In regard to the lower part of this tract, we have also to consider diverticulitis as a cause of rupture, and various types of intestinal obstruction due to bands, internal hernia, foreign body, volvulus, carcinoma and stricture. Furthermore, conditions of the pancreas, either inflammatory or necrotic, must also be considered, as must the liver and its adnexa. The respiratory system affords possibilities of inflammatory conditions of the left lung and pleura, while pulmonary infarction must not be forgotten. In the genito-urinary system inflammatory conditions of the kidney and its adnexæ, renal calculus and infarction are remote possibilities, while similar remarks apply to the cardio-vascular system, especially the aorta and its branches, it being borne in mind the patient has had syphilis for 12 years. An important consideration in this case is the possibility of rupture, either traumatic or spontaneous, of the spleen. Finally, the possibility of lesions of the osseous, articular and nervous systems, mainly the spinal cord and its coverings, cannot be neglected.

This is the broad canvas on which we have to work; but before I commence on a detailed discussion of these possibilities, I would like to say something on what I consider to be the key to the diagnosis—that is, the finding of absent liver dullness. This is a most important finding, and the question arises as to whether we can take it at its face value. If we do, the field is considerably restricted. We must assume that a reasonably careful physical examination had been carried out. If this is so, the absence or diminution of liver dullness can be accounted for only by transposition of the viscera, by the presence of free gas or by some few other conditions. These other conditions that may give rise to signs suggestive of diminished or absent liver dullness are gross ascites, marked shrinkage of the liver due to acute or chronic disease, emphysema, right-sided pneumothorax, or gross distension of the small or large bowel. There is nothing in the protocol to suggest a possibility of any of these conditions. Therefore, unless this patient is a *rara avis* with transposition of the viscera, I conclude that the absence of liver dullness is due to free gas in the peritoneal cavity, and that attention is directed to the sites from which the gas may have come. The likeliest of these is the alimentary tract.

The history and the findings of fever, tachycardia, abdominal pain, tenderness, rigidity, distension, and leucocytosis with neutrophilia strongly indicate that peritonitis is present, and when this is added to the presence of free gas in the peritoneal cavity, they point to perforation of some part of the alimentary tract.

Of the two common conditions that may cause this, perforated peptic ulcer would appear to me to be the more probable diagnosis. The onset of pain in the upper part of the abdomen, especially on the left side, suggests a high gastric perforation. The other condition that has to be considered is perforation of the colon in the region of the splenic flexure, which may be due to carcinoma, diverticulitis, ulcer, or trauma, direct or indirect. One other possibility which may mimic the foregoing conditions is intestinal obstruction by band or internal hernia, which has led to gangrene of the bowel. I must say, however, that the absence of vomiting with a 30 hours' history of abdominal pain indicates that this possibility is remote.

Before committing myself to a specific diagnosis, I wish to ask Dr. Hirst whether he has information which will enable him to answer the following questions. Firstly, the most important question is whether there is any indication that the patient had transposition of the viscera. I will be satisfied with information regarding the position of the apex beat, and the position of the heart. Secondly, are there any details regarding journeys outside Australia, or is there any history of trauma associated with the onset of the pain? For example, did he suffer a blow, or was he threatened by compressed air if it was used in those days?

DR. CALOV: At this point no further information will be given. I would like you to proceed only with the information in the protocol, and this will provide others with the opportunity to enter into the discussion on this basis.

DR. ROSE: In the absence of these details, then I can only conclude that the sudden onset of the pain, the signs of peritonitis and the absent liver dullness which I provisionally interpret as due to free gas in the peritoneal cavity indicate perforation of a viscus, which, I think, is a perforated gastric ulcer.

DR. CALOV: I will call on other speakers to continue the discussion.

DR. W. EVANS: I agree with Dr. Rose that this case, with its brief history, is a difficult one. The possibility of a ruptured viscus was my first thought also; but I think there are some points against this diagnosis, and these are the absence of vomiting and the fact that the bowels were open. Moreover, the rigidity was not generalized and was located in the left upper quadrant. In addition, it must have been a very quick leucocytic reaction to produce 24,000 leucocytes so soon after the onset.

I have considered other conditions, especially aneurysm, in view of the patient's history of syphilis 12 years before. But it usually takes longer than this to produce an aneurysm of the aorta. Another possibility is pyelitis, which may have been due to prostatic infection persisting and tracking up to the left renal region and producing an infected pyelonephritis, and which could have ruptured later. However, he was apparently in good health and had no urinary symptoms. I do not like to ask if he had any pus in the urine, because I am sure the question will be rejected, and I think there is a great deal of evidence against pyelitis.

A possible diagnosis which cannot readily be disposed of is pneumonia. The patient had a sudden onset of pain in the left upper abdominal muscles, a respiration rate of 38 per minute and leucocytosis. Pneumonia indeed cannot readily be discarded, and I have seen an appendix removed in similar circumstances in the presence of abdominal rigidity due to pneumonia. There is, however, no explanation for the absent liver dullness in the diagnosis of pneumonia unless the history at that period was not reliable.

A final possibility is pancreatitis. This is often diagnosed as a ruptured viscus or intestinal obstruction, and this patient had abdominal distension and rigidity.

In my opinion the two most probable diagnoses are pneumonia and pancreatitis, but which is the more likely I would not like to say.

DR. K. KIRKLAND: Frankly, I do not think this patient's trouble originated in the renal tract. If there were a pathological change in the kidney of sufficient severity to cause pain, left muscular spasm and meteorism, there would be other symptoms and signs indicative of renal disease. Of course, acute perinephric abscess can occur. I do not think any attention need be paid to the previous gonorrhœa. Gonorrhœa in those days got better very much more quickly than later, when it was treated. Admittedly, lower tract infections may lead to upper tract or renal pathology with resulting pyelonephritis, stone formation, sometimes with impaction, and pyonephrosis. In this case, I think we will have to look outside the urinary tract for the cause of the trouble, and as the case does not appear to be urological, I do not feel competent to discuss the probable diagnosis. However, that of ruptured viscus seems the most likely to me.

DR. B. R. M. HURT: I came along to this conference because I thought I had lost the second part of my protocol. The possibilities that come to mind have been mentioned by Dr. Rose and Dr. Evans, and I agree with Dr. Rose that the diagnosis appears to be ruptured viscus, most likely the stomach. However, in such cases one uses experience of Sydney Hospital, notes the fact that the patient was admitted 40 years ago, and remembers that most unusual specimens can be found in the Pathological Museum. In particular, I remember seeing a large splenic cyst, and I have long suspected that one day the pathologists will present that case for discussion, because I do not think they know what caused it. It is a possible explanation of the symptoms in the patient now under discussion. Has this man blood in the peritoneal cavity? The tenderness localized on the left side would be in favour of, say, a ruptured spleen, which Dr. Rose has mentioned. It may have been traumatic and/or spontaneous, and I think his questions regarding sojourn in the tropics and trauma, which he has already posed, are very relevant.

We must consider the major finding of absent liver dullness which indicated the rupture of a hollow viscus, and since this cannot be disregarded, I feel, as does Dr. Rose, that the diagnosis must be ruptured ulcer—probably gastric.

DR. CALOV: Dr. Whyte, would you care to comment perhaps on the leucocytosis?

DR. H. M. WHYTE: I think that leucocytosis can occur with great rapidity. For example, on running around the Domain once, mine reached 15,000 per cubic millimetre. I

think the possibilities have been fairly fully discussed and I have nothing further to add.

DR. J. M. YEATES: Dr. Evans commented on the leucocyte count, indicating that he was surprised at its rapidity. However, I have a patient in the hospital now who suffered acute abdominal pain at 3 a.m., and by next morning he had a leucocytosis of 27,000 per cubic millimetre. The patient also had a temperature of 102° F. At operation he was found to have a volvulus with gangrene of about two feet of the small bowel and some blood in the peritoneal cavity. The interval between onset and leucocytosis was less than 12 hours. My second point is that of the abdominal rigidity in this case. While it is possible for some abdominal rigidity to be present in cases of pneumonia, in my experience, any marked abdominal rigidity is associated with a lesion necessitating abdominal exploration. The teaching that rigidity occurs in chest lesions has been rather done to death.

There are several possibilities in this patient that have not been sufficiently considered. These are volvulus and thrombosis of the vessels of the small bowel, which are usually regarded as being somewhat rare. But I have not found to be so rare in Sydney Hospital such lesions as true volvulus or loops of small bowel caught under a small band and twisted. The protocol states that the bowels were open, but there is no detail as to when they were open in relation to the onset. I think we should consider these two possibilities—that is, volvulus or thrombosis of the vessels of the small bowel in this case. The temperature of 102° F. could have been due to blood in the peritoneal cavity, as in the case I mentioned earlier.

DR. CALOV: I now call on Dr. Hirst to answer the questions posed by Dr. Rose.

DR. E. HIRST: In percussing along the left nipple line commencing at the sixth rib and extending to one finger's breadth below the left costal margin, there was an area of absolute dullness. The apex beat was in the fourth right intercostal space, 10 centimetres from the mid-line. We do not know if he lived outside Australia, and there is no evidence of a blow or of assault with compressed air.

DR. CALOV: I call on Dr. Rose to comment on these revelations.

DR. ROSE: As I mentioned before, I thought the key to the diagnosis was the interpretation of the absent liver dullness. In view of the finding of the heart in the right side of the chest and of the liver dullness on the left side, it indicates that the patient had transposed viscera; but I thought this to be even too rare for a clinico-pathological conference. Therefore, in these circumstances we have to take into consideration lesions of organs normally found on the right side of the abdomen—namely, the appendix and gall-bladder. Moreover, the change in the position of the upper part of the alimentary tract has also to be considered.

In these circumstances, the possibilities now include cholecystitis, appendicitis, and instead of a high gastric ulcer a duodenal ulcer, with perforation. However, it appears to me that the suddenness of the onset is more consistent with a perforation than with the other possible lesions. Therefore, in the light of these findings I would like to modify my diagnosis to that of a surgical abdominal lesion in a patient with transposition of the viscera, most probably perforated duodenal ulcer.

Surgical Revelation.

DR. CALOV: I now call on Dr. George Bell to reveal the details of this patient's illness.

DR. G. BELL: I recall the circumstances of this patient very well. One of Dr. Rose's predecessors, Dr. Walter Perry, described the clinical history to me on an occasion when I was bound for the operating theatre. Fortunately for me, I was able to make my physical examination under ideal circumstances, and I found on simple inspection that the patient's abdomen was nearly immobile and that the apex beat was on the right side. Further examination confirmed the presence of the heart on the right side and an area of absolute dullness on the left side corresponding to the liver. I have a sort of "transposition complex", because as an undergraduate, one of the first post-mortem examinations I saw was that of a girl who had transposition of the viscera, and who died of chlorosis, which in these days is not a common disease. Dr. J. G. Edwards confirmed our clinical findings with an X-ray examination of the chest and also with a bismuth meal X-ray examination, which showed transposition of the stomach also. In view of this we made a diagnosis of probable appendicitis or cholecystitis on the left side. I made a paramedian incision and found marked peritonitis in the region of the gall-bladder, which was inflamed and distended. Turbid fluid was aspirated from the gall-bladder, from which coliform bacteria were subsequently cultivated. Upon opening the gall-bladder, I removed a gall-stone about the size of an olive and a number of small ones, and I put in a drainage tube and closed the abdominal incision. The drainage tube was removed 17 days later, and 19 days after this the wound had healed. Eighteen days later, however, acute cholecystitis recurred, and cholecystostomy was again performed. After this the patient recovered.

It was the usual thing in those days to perform cholecystostomy, but this, of course, has now been replaced by cholecystectomy in most cases. I cannot say just when cholecystostomy was abandoned. Subsequently, we found that the right testis hung lower than the left.

I thought it very clever of Dr. Rose to consider transposition in this case on the information he was given.

DR. E. H. STOKES: I recall that it was about 1923 that cholecystectomy replaced cholecystostomy for the treatment of cholecystitis. As regards this patient, we were able to persuade Dr. Bell to record the case, and it appeared in THE MEDICAL JOURNAL OF AUSTRALIA on April 10, 1920, under the authorship of himself and Dr. R. C. Winn.

Diagnosis.

Acute cholecystitis with gall-stones and transposition of the viscera.

Correspondence.

PSYCHIATRIC ASPECTS OF CHILDHOOD EPILEPSY.

SIR: In an article on the "Psychiatric Aspects of Childhood Epilepsy" (M. J. AUSTRALIA, August 3, 1957), Dr. Edward Nuffield states: "Psychiatrists and psychologists continue to speak of epilepsy as a unitary entity, while neurophysiologists and neurologists have abandoned this concept and speak of the 'epilepsies'. As a result the two sides are often arguing at cross purposes when specific phenomenological and ætiological problems are raised." Historically this statement is untrue. A century ago, psychiatrists had an unsurpassed clinical knowledge of the epilepsies. It is a portion of psychiatry's lost factual heritage. Epilepsy was never regarded as a unity.

In 1892, Hack Tuke edited an account of the "Epilepsies and the Insanities", in which he lists forty variants. In 1895, in his "Pathology of Mind", Henry Maudsley describes the "minor epilepsies". Continental writers such as Esquirol and Morel were absorbed in the protean nature of epileptic phenomena.

The notion of epilepsy as a unitary concept arose with the neurologists. Gowers (1907) wrote: "Diagnose epilepsy if loss of consciousness is sudden or its return sudden, and there is mental confusion." Gowers also stated: "It is foreign to our thoughts to conceive the idiopathic epileptic attack as capable of extension. . . ." Dr. Nuffield discounts the venerable belief in the endogenous genetic basis of the epilepsies, and in company with many observers in the New World, turns to an optimistic exogenous causation. He concedes that Lennox adheres to a genetic ætiology, but he describes the German and French schools as "archaic".

For centuries, observers in the Old World observed large family groups and static samples of population. Diffusion was negligible. Present conditions in Canada, the U.S.A. and Australia are the very opposite. Penfield confined his history taking in the New World to "close relatives". He does not discard "genetic epilepsy". He states that "it is true that hereditary predisposition plays a larger role in the etiology [*sic*] of seizures among patients in this group" (*i.e.* centrencephalic). Penfield does not discard the term "idiopathic", but uses it as often as his "cryptogenic".

The epilepsies, like the schizophrenias, are universal in their incidence and occur in all races and cultures. They were known as far back as recorded history, and were endemic in the human race ages before Swedish history began. The Swedish marriage law (1758) was a testimony to the compelling nature of the evidence then existing. Its apparent failure, quoted by Dr. Nuffield, does not rebut the hereditary transmission of the epilepsies. A heterogenous clinical concept can never be fitted into a Mendelian framework.

The constitutional approach to psychiatric disorders does not lead to "therapeutic nihilism"—an absurd phrase. To define the constitutional limitations is the essence of sound therapy. Enthusiasm for electroencephalography is not always well founded. Separated from clinical facts, the results are dubious.

The current welter of therapies in contemporary psychiatry may do grave harm. Few modern psychiatrists have any knowledge of the natural history of the disorders they treat. To "liberate" patients into our complex, industrialized environment can often be cruel, and sometimes dangerous. Indeed, therapies are becoming more euphoric as society becomes more complex.

Yours, etc.,

27 Great James Street,
Bedford Row,
London, W.C.1,
England.
September 30, 1957.

BARRY MULVANY.

CONSIDERATIONS IN THE DIAGNOSIS OF A BREAST TUMOUR.

SIR: This excellent article by Dr. Leggett (M. J. AUSTRALIA, October 5, 1957, page 499) presents a well-balanced account of the clinical considerations in diagnosing a breast tumour. However, by omission of any emphasis on or even direct reference to biopsy, it might give some people the impression that it is justifiable to make a definite diagnosis on clinical signs and symptoms in the absence of a biopsy.

Medicine progresses. Fifty years ago it may have been permissble to treat a fracture without an X ray. Now it is not. Similarly it is no longer justifiable to come to a definite diagnosis, and to base treatment on it, regarding a tumour or other suspicious lesion in the breast without a biopsy. The same applies to any tissue under suspicion of malignancy anywhere in the body, unless there exists a specific contraindication in that particular case.

In the case of the fracture we may risk unnecessary deformity if we omit X rays. In the case of a tumour in the breast we risk the patient's very life if we proceed without biopsy, or we may subject her to a severe radical operation which may turn out to be unnecessary.

It is regarded as culpable negligence to treat a fracture without an X ray. Even more so it should be regarded as prima-facie evidence of malpractice to treat a tumour of the breast without a biopsy. This is all the more necessary because the stage at which we need to discover and treat these lesions is when they are first perceptible either as a lump or thickening.

Then, of course, there are more of the signs of advanced malignancy that have been taught to us as the "classical signs". In this respect it is well to remember that an intelligent woman who examines her own breasts regularly is capable of detecting lumps, thickenings or other differences from normal, that may well be significant a month or more before the most careful doctor can make them out even when they are pointed out to him by the patient. In this connexion there are several cases well worth quoting if the trespass on your space may be forgiven (Klopp *et alii*, *J.A.M.A.*, 1952, 150: 856).

Minimal Mass.—A 54-year-old woman was first examined because she thought she felt a lump in her right breast five days prior to coming to the clinic. She may have noted a few drops of yellow discharge from the nipple of the right breast on one occasion one year previously. On examination, slight thickening was noted in the upper inner quadrant of the right breast. There were no skin changes; the nipple was normal, and axillary nodes were not palpable. The left breast was normal.

Within a week of the initial visit, she was presented at a tumor conference and was examined by seven competent physicians. All agreed that there was no lump in the breast. Slight ecchymosis was noted in the breast quadrant that was under suspicion, and the patient recalled having received a slight blow in this area a week before the initial examination. Because of inability to outline a definite mass and the presence of minimal ecchymosis associated with a history of trauma, it was decided to observe the patient.

One week later the thickening was still present. The patient had become extremely anxious and requested further investigation, specifically requesting surgical excision of the breast quadrant in question. With some misgivings, this was done. In the center of the excised tissue, a cancer, 3 mm. in diameter, was found. After the histopathologist confirmed the clinical diagnosis, a radical mastectomy was done. No metastases were found in the axillary lymph nodes, and her subsequent course was uneventful.

Comment.—This patient came for treatment before a true breast mass could be outlined. The findings were explicable by the history of minimal trauma. Had it not been for her own insistence, she would have been observed for weeks, as the breast had been declared by seven competent medical examiners to show no clinical evidence of pathological change. This demonstrates that minimal changes can occur that are apparent to the patient, but that may not be discerned by the most capable and conscientious physician. This situation is apt to occur whenever the patient is a discerning woman who takes exceptional care of her person or who heeds the advice given in the film "Self Examinations of the Breast". Hence, all examining physicians must fully realize the need for securing microscopic proof of the nature of even the most minimal changes in breast tissue and of paying heed to the observations of intelligent women patients.

Minimal Change in the Nipple.—One year before examination, a 40-year-old woman observed a change in the right nipple. (She could not describe it further.) The breasts had also become firmer. Because her mother and one sister had died of breast cancer, she requested examination by a physician in the tumor clinic.

The initial physical examination was performed by an intern, who described an elevation and erythema of both nipples and a "crack" on the right nipple. He also described a mass 3 to 4 cm. in diameter in each breast. When examined by the attending surgeon, no true masses were found in either breast, those noted by the intern being of normal lobular consistency for breast tissue of a thin woman. Both nipples were erect and seemed firmer than usual, especially the one on the right, which contained a fissure 5 mm. in length surmounting a suggestion of a nodule. Both axillas were considered normal. Because of the family history, the presence of a small fissure with a suggestion of nodularity beneath it, and the patient's insistence that her sister's cancer had begun in the same manner, the fissured area, measuring 5 by 1 mm., was excised. On microscopic examination it was found to be adenocarcinoma.

After receiving this unexpected histopathological report, the question arose as to whether a similar process might be present in the other breast, which had the same firmness but no overlying fissure. The patient insisted that such was the case and that the changes first observed by her in the right breast were identical to those now present in the left breast. A surgical specimen, 7 by 4 by 3 mm., obtained from the left nipple and submitted to the pathologist was found to be an intraductal papilloma containing hyperplastic areas and hyperchromatic cells; however, there was no evidence of invasion.

A right radical mastectomy was done. No further cancer was found in the excised breast or axillary nodes. Six weeks later, at the patient's insistence, a left simple mastectomy was done. Additional intracystic papillomas were found.

Comment.—This patient came to the clinic for evaluation of a nipple change so minimal that a less experienced examiner was more concerned over the nodular consistency of the tissue in both breasts than the slight nipple change. If a "routine" physical examination had been done, it is unlikely that the physician would have noted any breast disease unless the patient, cognizant of the importance of minimal nipple changes, had focused his attention on the area. It is probable that this represents the limit of our present clinical ability to detect cancer arising just beneath the nipple.

SIGNS AND SYMPTOMS OF EARLY BREAST CANCER.

There are no symptoms of early breast cancer. The visible signs are (1) persistent scaling of the nipple, (2) slight ulceration of the nipple, (3) drop of discharge from the nipple (bloody or serous), and (4) persistent shadow on transillumination. The palpable signs are (1) slight thickening of the breast, (2) a tiny lump in the breast, (3) slight thickening of the

nipple, and (4) a nontender axillary lymph node that is larger than 1 cm. in diameter.

Although it is recognized that these signs may represent changes that have taken place over a period of years, they (excepting the shadow on transillumination) represent the findings for which all physicians should search in examination of the breasts of every woman. These are not indications for a "wait and watch" program, but are indications for surgical biopsy. A cutting biopsy should be considered as a diagnostic procedure to be used with no more hesitation than a venipuncture. A breast cancer detected because of the presence of one of these signs and adequately treated by radical mastectomy might be expected to yield a cure rate in excess of 70%.

In order to detect these minimal changes, each examining physician must become thoroughly familiar with (1) the consistency of the normal female breast and (2) the appearance of the normal nipple. The normal variations of age, weight and build must be appreciated, but can be learned only by first-hand observation. Once this normal range is known, the simple rule is to require a histopathological diagnosis of every deviation from the normal. Such a course will result in discovery of cases similar to the ones discussed.

Among the signs we might add retraction or œdema of skin of the breast, which can occur in the absence of a palpable tumour.

It is not so vital whether we do a frozen section immediately before operation or a deliberate paraffin section, with operation within three or four days if required. What is essential is that we have the highest possible index of suspicion, that we proceed to biopsy without any delay for observation or any other reason, and that definitive treatment should be immediate, adequate and based on all the relevant factors, including biopsy in every case.

To sum up and simplify, there are in general only two significant considerations in the diagnosis of malignancy in the breast or elsewhere: (i) any sign or symptom that arouses suspicion of malignancy in the mind of the doctor (or patient?), and (ii) the pathologist's report in the next day or so on the section of the tissue under suspicion. The sooner we adopt this general attitude, the sooner will the present terrifying mortality rate of cancer commence to fall.

Yours, etc.,

100 Collins Street, A. McQUEEN THOMSON.
Melbourne,
October 11, 1957.

PSYCHIATRIC CONSEQUENCES OF RAUWOLFIA THERAPY.

SIR: My attention has been drawn to the correspondence on the "Psychiatric Consequences of Rauwolfia Therapy" (M. J. AUSTRALIA, September 7, 1957). Dr. Frank L. Ritchie states the classical view in the matter of exogenous psychoses. It is nonsense to talk of psychoses being caused by drugs unless a large number of carefully controlled cases are presented. Mayer Gross, Slater and Roth enter this field warily. They begin with the classical observations of Bonhoeffer (1910), who showed that the form of an exogenous psychosis was independent of the underlying physical cause.

In terms of the vast amount of human stress (infections, intoxications and drug administrations), psychotic and psychoneurotic sequelæ are very rare. Dr. Ritchie underlines the two important points of the unmasking of a reaction which is already there, and the absurdity of lay publicity. The latter is not a unilateral affair.

Clinically Dr. Whitaker goes this far with Dr. Ritchie; but he refers to the "hallucinatory schizophrenia-like psychoses that are almost invariably produced by mescaline and lysergic acid diethylamide". This statement occurs frequently in the literature, although the resemblance of these conditions to schizophrenia originates in the mind of the observers. They are finely spun toxic-confusional states, in which visual hallucinatory and visual illusory phenomena predominate. Occasionally in the acute confusional stages of the schizophrenias, hysterical twilight or toxic-confusional components do occur, and respond to appropriate measures. The initial success of these measures has given rise to premature notions of ætiology. The basic hallucinatory phenomena of the schizophrenias cannot be produced by external means.

Auditory hallucinations are very rare in the experimental psychoses.[1] Their production in clear consciousness by experimental means appears to be unknown. A minor qualification exists in regard to alcoholic hallucinosis. Not only is this uncommon among alcoholic psychoses, and the related nutritional encephalopathies, but is often placed among the schizophrenias. It is simply schizophrenia unmasked by alcoholism.

External causation in psychiatry has always been on a provisional and hypothetical footing, despite the solace it offers mankind. Vulgar bogies, implicit in the rauwolfia incidents, often outstrip reason.

Yours, etc.,

London, BARRY MULVANY.
October 18, 1957.

ILLNESS IN TWINS: II. DUODENAL ULCER.

SIR: With regard to the article by Doig, "Illness in Twins: Duodenal Ulcer", on page 617 of THE MEDICAL JOURNAL OF AUSTRALIA, October 26, 1957, I would like to add some further comments. I read with great interest the article, and agree with Doig that it appears that a great deal too much emphasis has been placed on genetic factors rather than environmental ones in the relationship of certain diseases. I feel that this applies particularly to duodenal ulceration, and to a lesser extent in cases of infantile eczema, asthma and perhaps in cases of ulcerative colitis. I would be interested to learn if any neurologists have made comparative studies of electroencephalogram patterns and the incidence of duodenal ulceration, asthma or ulcerative colitis.

Finally, I would like to report a further case of duodenal ulceration occurring in twins. Both are males, aged 46 years.

A. Ulcer first detected radiologically in 1943 after symptoms of epigastric discomfort, belching and relief with alkaline powder and mixture. He had several periods of hospitalization on ulcer therapy and has never had a hæmatemesis or melæna.

B. Ulcer first detected radiologically in 1957 after a rather sudden severe hæmatemesis and melæna following on several months of upper abdominal pain. Now well controlled with antacids and anticholinergic agents.

Both these patients are similar in nature and habits, and are so alike physically that it is very difficult to tell them apart. They have one elder brother and one elder sister, both of whom are apparently quite well. One has an 18-year-old daughter who has recurrent attacks of epigastric upsets with relief by antacids. However, barium meal in 1956 failed to disclose any evidence of peptic ulceration.

Yours, etc.,

Box 124, W. LAWRENCE.
Red Cliffs,
Victoria.
October 31, 1957.

MATERNAL AND FŒTAL PROGNOSIS IN TOXÆMIA OF PREGNANCY.

SIR: Dr. John Chesterman's letter (October 26, 1957) interested me very much. I have no evidence to contradict the teaching of my friend, the late Dr. Dixon Hughes, that, if the diastolic blood pressure is consistently raised by more than 10 millimetres of mercury above the basic blood pressure as estimated at the first visit to the ante-natal clinic, the patient should be regarded as in the initial stages of toxæmia and admitted to hospital, and certainly his view, if it is incorrect, errs on the safe side. Notwithstanding, it is I think useful, and indeed necessary, to have a standard of normal blood pressure for the purposes of classification and prognosis. If, for example, the pregnant woman's initial blood pressure is above a certain level, she may be regarded as a "chronic hypertensive", and as therefore starting her pregnancy with a certain handicap, in that she is more likely to develop superimposed preeclamptic toxæmia. What the standard of normal should be is debatable, though I continue to regard it as 120/80.

Dr. Chesterman quotes Hamilton *et alii*, who state, after a survey of arterial pressure in the general population: "The

[1] Smythies, J. R. (1956), "Analysis of Perception", Routledge & Kegan Paul.

most notable conclusion is that average arterial pressure in the general population rises with age." With this statement I agree, but would point out that the key word is "average". The word "normal" means "average", or "usual". It does not necessarily mean "healthy". What Hamilton *et alii* found is that it is usual for a woman in her eighties to have a blood pressure over 180 millimetres, systolic, but that does not mean that her blood pressure is healthy, though no doubt she is pleased when her doctor tells her that it is normal. He knows that all he means is that her high blood pressure is usual at her age, and that though it is normal, she may have a stroke before the week is out. It would be just as true to say that because most women have decayed teeth at 70, therefore decayed teeth are healthy, though, to be sure, they are "normal" in the strict meaning of the word, or that arteriosclerosis, which is no doubt present in most people in their seventies, is physiological. All I ask is that when we use the word "normal" we are quite clear as to what we mean.

Yours, etc.,

F. J. BROWNE.

2 Gillies Street,
Wollstonecraft,
New South Wales.

Undated.

PROTHROMBIN DEPRESSANTS AND SODIUM FLUORACETATE IN RAT CONTROL.

SIR: I am very interested in the paper by W. R. Horsfall entitled "Prothrombin Depressants and Sodium Fluoracetate in Rat Control" in the October 12 issue of THE MEDICAL JOURNAL OF AUSTRALIA, and would like to make a few comments.

Although it is correct that coumarin derivatives, including warfarin, are useful rodenticides, it should be added that a small number of rats have been found resistant to the action of dicoumarol drugs.[1] It would therefore be of advantage to have alternate drugs available.

It appears from preliminary observations that drugs of the indandione group may be a satisfactory choice.[2]

I cannot share the optimism of Horsfall that accidental poisoning of animals or even man is unlikely to happen in this country, because I had occasion to investigate a hæmorrhagic tendency in a seven-months-old girl, in whom there was grave suspicion that the girl was accidentally given rat poison in food; and warfarin poisoning by a daughter-in-law has been described, necessitating several hospitalizations of the unfortunate mother-in-law.[3]

From these facts it seems desirable that legislative action should be taken to ensure that rat poisons of any type are adequately marked for easy identification, for example, by requiring some specific colouring of the article.

Yours, etc.,

P. FANTL.

Baker Medical Research Institute,
Alfred Hospital,
Commercial Road,
Prahran, S.1,
Victoria.

October 31, 1957.

PSYCHOTHERAPY IN GENERAL PRACTICE.

SIR: I would like to comment on Dr. Jansen's second paper on "Psychotherapy in General Practice (M. J. AUSTRALIA, September 28, 1957). The treatment he has been giving his patients in a general practice in a country town is remarkable in many respects: in respect of his vision in the first place, in respect of his courage and perseverance, and of his skill and success.

I was particularly interested to read his correlation of stress and appendicitis: "It does seem, however, that these organs [appendix and tonsils] are more susceptible to infection when the patient is under adaptive stress." In respect of the appendix, this has been the impression gained from my own clinical experience, to such an extent of conviction that I have indicted emotional stress as the main cause of acute appendicitis in numerous post-graduate lectures over the past five years.

The mechanism is fairly straightforward in the case of acute appendicitis, the first stage being an autonomic dyspraxia, whether the condition resolves or proceeds to an abscess or gangrene according to circumstances. By definition, autonomic dyspraxia is an unstable condition of the autonomic nervous system of central origin, the result of an emotional overload, causing peripheral malfunction of smooth muscle or gland. In the case of the appendix the smooth muscle is situated in its muscular layer of circular fibres, and the malfunction is spasm. As in all biological phenomena, the intensity and duration of the spasm can vary through all degrees from the minimum to the maximum. A spasm of maximal degree results in gangrene of the organ in a comparatively short time, either through its peninsulate shape or through a simultaneous spasm in the smooth muscle of the appendicular artery. Secondary bacterial invasion from the lumen occurs rapidly. If a foreign body has been present beforehand, the malfunction and its sequelæ will be all the more severe. In the lesser grades of severity, the spasm is intermittent or passes before complications develop. The patient has suffered appendicular colic. The organ has been tender to palpation. But by the time anæsthesia has relieved the spasm and the organ has been displayed, there is little to see as far as gross pathology is concerned. One well-plucked eyebrow is elevated in reply to the message of another. But they are both wrong. The patient had suffered an acute appendicitis and not the surgeon a wrong diagnosis.

The central component, an emotional crisis, is usually overlooked in the emergency. In many cases it is surprisingly superficial if sought. An approaching examination, *Œdipus rex* or Cupid are often playing havoc with the youthful patients so often struck down.

Surgery, apart from being indispensable in many cases, usually provides effective, if unrecognized, psychotherapy. The emergency and the threat to life (distraction therapy), the enforced change in environment and in social relationships, usually solve the sociological problem which precipitated the appendicular malfunction.

There are many other details of Dr. Jansen's paper I would like to comment upon if space allowed. It will suffice to say that if all patients were treated similarly in the first days or weeks of their illness, there would not only be fewer cases of psychoneurosis, but there would be few cases of accelerated hypertension, chronic peptic ulcer, severe asthma, shoulder-hand syndrome and many other diseases in which the iatrogenic factor is considerable.

Yours, etc.,

BRIAN HAYNES.

Craignish,
185 Macquarie Street,
Sydney.

October 22, 1957.

Post-Graduate Work.

LEGACY CLUBS OF AUSTRALIA.

John Gellibrand Memorial Scholarship (1958 Award).

THE Legacy Coordinating Council announces the following conditions for the John Gellibrand Memorial Scholarship (1958 award).

The scholarship has been established by the Legacy Clubs of Australia in memory of the late Sir John Gellibrand, for the purpose of enabling children of deceased Australian servicemen, who are or have been members of a junior or intermediate Legacy Club, or who are or have been eligible for membership thereof and who have graduated from an Australian university, to spend a period of two years in research, investigation or other study in the United Kingdom.

The scholarship is held for two years at an approved university in the United Kingdom.

The value of the scholarship is not less than £900 (Australian) for each of two years, payable in instalments from time to time as required.

The scholar will be selected by a committee composed of the following persons: the Chairman of Legacy Coordinating Council (or his nominee); the President of the Legacy Club in the captial city of the State from which the selection is to be made; the vice-chancellor of the university (or his nominee) in the State from which the selection is to be made. Selection will be made from the States in the following rotation: Victoria, Tasmania, South Australia, Queensland, Western Australia and New South Wales.

[1] *Federation Proc.*, 1957, Volume 16, No. 1.
[2] *J. Hyg.*, 1956, 54: 20.
[3] *Acta hæmat.*, 1957, 17: 129.

Should there be no scholar eligible or of the required standard in the State from which the selection is due to be made, then the selection will pass to the next State in order of rotation, and so on, until a selection is made. A State which fails to supply the scholar in its turn shall have priority for the next selection. Scholars have already been selected as follows: 1948, Tasmania; 1950, South Australia; 1952, Queensland; 1954, Western Australia; 1956, New South Wales. The selectors will take into consideration (i) the scholastic attainments, (ii) character, sincerity of purpose and a manifestation of spirit of service, (iii) physical fitness, (iv) service in the Defence Forces, (v) service in Legacy.

The regulations governing the scholarship are as follows:

1. Scholarship funds must be faithfully applied for the purpose for which they are paid.

2. A scholar must abide by the rules of the university where he is pursuing his studies.

3. Scholars must keep the Legacy Coordinating Council informed of their addresses at all times, especially during vacations. If scholars absent themselves during the tenure of their scholarship and fail to notify the Council of their addresses, their grants may be suspended.

4. No scholar may take paid employment during the period of his scholarship, nor may he accept remuneration from his place of study without the express approval of the Council.

5. Scholars must submit regular reports to the Council on the progress of their studies.

6. If the Council considers that a scholar has not applied himself adequately to his studies, or if it considers his conduct unsatisfactory, the Council may suspend payment of further money and take other action it considers desirable.

7. The Council's decisions in all matters affecting the scholarship shall be final.

Application must be made on the prescribed form (Form J.G.M.S./1958), which should be lodged with the Honorary Secretary of the Legacy Club in the capital city of the State in which the applicant is resident, not later than December 1, 1957. In Victoria the Honorary Secretary is Mr. L. M. Nixon, and the address is 90 Bourke Street, Melbourne, C.1. The successful candidate should be ready to travel to England in July or August, 1958.

Entrants for the scholarship for the current year must be bone-fide residents of Victoria.

THE AUSTRALIAN POST-GRADUATE FEDERATION IN MEDICINE.

THE address of the Executive Office of the Australian Post-Graduate Federation in Medicine, formerly at 394 Albert Street, East Melbourne, Victoria, is now as follows: University of Adelaide, North Terrace, Adelaide, South Australia. Telephone: W 3211. Telegrams and cables: "Postgrad", Adelaide.

The Federation's members are the medical post-graduate committees in the different States, and the Executive organizes visits of overseas lecturers to Australia and provides liaison with overseas organizations. In addition to bringing visitors to Australia, the Federation arranges for lectures by others who, they hear, are coming to this country independently of Federation help. The Executive will welcome news of any such possible lecturers.

Any other information which is likely to assist post-graduate education will be welcome also.

Congress Notes.

AUSTRALASIAN MEDICAL CONGRESS (BRITISH MEDICAL ASSOCIATION).

THE Executive Committee of the Australasian Medical Congress (British Medical Association), Tenth Session, to be held at Hobart from March 1 to 7, 1958, has forwarded the following notes for publication.

Owing to the fact that Her Majesty the Queen Mother will be in Australia at the time when the Congress is being held in Tasmania, several modifications in the programme have been necessary.

Although the Inaugural Meeting will still be held in the City Hall, Hobart, as originally planned, the proceedings will not be opened by the Patron, His Excellency the Governor-General.

It has been necessary to change the night of the Sir Henry Simpson Newland Oration, which is to be given by the Right Honourable the Prime Minister, to the night of Wednesday, March 5, 1958, instead of March 6, as previously advised.

The subscription dinner will now be held at Wrest Point on the evening of Thursday, March 6. Circulars will be sent to Congress members regarding the dinner at a later date.

Anyone who intends coming to Congress, but has not yet joined, is asked to do so now. Forms for application for membership are obtainable from the State Secretaries of Congress.

The College of General Practitioners.

QUEENSLAND FACULTY.

Annual Report.

THE Board of the Queensland Faculty of the College of General Practitioners sends the following report for the Faculty for the year 1956-1957.

The office bearers for the year 1956-1957 are as follows: *Provost*: P. W. Hopkins. *Faculty Board*: Chairman, H. S. Patterson (Faculty representative on the College Council); Vice-Chairman, L. P. Winterbotham (resigned December, 1956); Honorary Treasurer, A. J. Parer; Honorary Secretary, W. J. Hamilton. *Members*: B. N. Adsett, I. H. Chenoweth, Ruth Chenoweth, H. W. A. Forbes, R. A. M. Miller, L. P. Musgrave, R. V. H. Spark, L. A. Little.

The following representatives were elected: Editorial Committee, *Annals of General Practice*, W. J. Hamilton; Australian Council Research Committee, I. H. Chenoweth; University of Queensland, Faculty of Medicine and Post-Graduate Medical Education Committee, H. S. Patterson.

The Secretary is R. Spence, and the postal address of the Faculty is Box 1498V, General Post Office, Brisbane. Messrs. R. G. Groom & Co. were elected auditors.

The membership of the Faculty numbers 80, including 18 associates.

The second annual meeting of the Queensland Faculty was held at B.M.A. House, Wickham Terrace, Brisbane, on Friday, August 24, 1956, at 4.30 p.m. This was followed by the annual dinner, held at the United Services Club, to which a number of distinguished medical guests were invited, including the Bancroft Orator, Professor J. C. Eccles, whose oration was delivered at the Medical School at Herston later in the evening.

A joint meeting with the Queensland State Committee of the Royal College of Obstetricians and Gynæcologists was held on September 13, 1956, in the new auditorium of the Mater Misericordiæ Hospital, Brisbane, where the Sims-Black Travelling Professor in Obstetrics and Gynæcology, Professor A. M. Claye, of Leeds, gave an address on "Post-Maturity".

The Jackson Lecture, which is an historical lecture delivered annually at a meeting of the Queensland Branch of the British Medical Association, was this year given on October 5, 1956, by the Provost of the Queensland Faculty, P. W. Hopkins. His subject, "Cutting for the Stone", was heard by a very large audience in the Main Hall of the Medical School.

The first post-graduate week-end to be organized by the Queensland Faculty was held at Lennon's Hotel, Broadbeach. It was attended by 57 doctors, most of them accompanied by their wives, and was an unqualified success. The principal guest lecturer was Professor Lorimer Dods, who occupies the Chair of Child Health at the University of Sydney. He gave two addresses entitled "Progress in Pædiatric Therapeutics" and "Some Everyday Pædiatric Problems".

Dr. Kurt Aaron was chairman at two panel discussions. The first was "The Therapeutic Indications for Cortisone and its Derivatives", and those taking part were Dr. R. W. Hawker (physiologist), Dr. L. D. Walters (physician) and Dr. Lorna Archibald (dermatologist). The second, on "The Modern Treatment of Hypertension", comprised Dr. R. W. Hawker (physiologist), Dr. R. F. O'Shea (physician) and Dr. C. A. C. Leggett (surgeon). The chairman of the Queensland Faculty (H. S. Patterson) read a cable from

the Secretary of the College (Dr. John Hunt) conveying the good wishes of the College Council. He also extended a very warm welcome to the chairman of the Australian Council of the College (Dr. W. A. Conolly), who had come from Sydney to attend the week-end, and to Dr. Felix Arden, President of the British Medical Association in Queensland. Dr. Patterson also made acknowledgement of the generous grant by Messrs. Pfizer Pty. Ltd. towards the expenses of the conference.

The Undergraduate Education Committee of the Faculty Board.

The office bearers of this committee are as follows: Chairman and Secretary: L. P. Winterbotham (to February 12, 1957), R. A. M. Miller.

The apprenticeship training scheme, inaugurated in 1955 by the University of Queensland as a result of a request of the Faculty, was continued in 1956. The Queensland Faculty is now pressing for the setting up of a General Practice Training Unit. Such a unit could be responsible for: (i) the coordination of the general practitioner apprenticeship scheme; (ii) organizing of lectures to senior students; (iii) ultimately the teaching of general practice to students in the teaching hospitals by general practitioners, who would be members of the hospital staff.

The University of Queensland Medical Society (the student body) offered its full support in the setting up of such a unit, and is publishing in its journal *Trephine* an article on "The Education of the Family Doctor" by the chairman of the Queensland Faculty.

The Post-Graduate Education Committee of the Faculty Board.

The chairman and honorary secretary is L. A. Little.

It is the aim of the Faculty to have facilities available at teaching hospitals whereby general practitioners, wishing to receive post-graduate practical training in such subjects as anæsthesia, obstetrics *etc.*, may spend periods of up to three months at such hospitals.

The British Medical Association in Queensland was requested to approach the Superintendent of the Brisbane General Hospital, the largest teaching hospital in Queensland, with some 1200 beds. As a result a conference was held between the hospital Superintendent (Dr. A. D. D. Pye), the President of the British Medical Association in Queensland (Dr. Felix Arden) and the chairman of the Queensland Faculty (Dr. H. S. Patterson). This proved disappointing, in that Dr. Pye stated that while general practitioners could act as "observers", he was not prepared to allow them to undertake practical precedures within the hospital.

The request that the Australian Post-Graduate Federation in Medicine should institute a correspondence course for isolated practitioners and others who were interested in such tuition was turned down by the Federation. It was, however, agreed to send representatives to a meeting convened to discuss the surgical training of general practitioners; this request has come from the Australian Council of the College.

The Research Committee of the Faculty Board.

The chairman and honorary secretary is P. W. Hopkins.

The committee has interested itself during the year in the radiation hazards of diagnostic radiology.

Naval, Military and Air Force.

APPOINTMENTS.

THE following appointments, changes *etc.* have been promulgated in the *Commonwealth of Australia Gazette*, No. 55, of October 17, 1957.

NAVAL FORCES OF THE COMMONWEALTH.

Citizen Naval Forces of the Commonwealth.

Royal Australian Naval Reserve.

Amending Seniority.—The seniority of Surgeon Lieutenant Kenneth Frank Shepherd is amended to 15th March, 1953.

Transfer to the Retired List.—Lieutenant-Commander Robert Mervyn Bailey and Surgeon Lieutenant-Commanders

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED NOVEMBER 2, 1957.[1]

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Australian Capital Territory.	Australia.
Acute Rheumatism	2(1)	2(1)	..	4	..	..	1	..	9
Amœbiasis	..	..	..	..	..	1(1)	..	..	1
Ancylostomiasis	..	..	..	..	..	..	..	..	..
Anthrax	..	..	..	..	..	..	..	..	..
Bilharziasis	..	..	..	..	..	..	..	..	..
Brucellosis	..	1	..	..	..	..	..	..	1
Cholera	..	..	..	..	..	..	..	..	..
Chorea (St. Vitus)	..	..	..	..	..	..	..	..	..
Dengue	..	..	..	..	..	..	..	..	..
Diarrhœa (Infantile)	..	3(2)	2(2)	..	6	..	2	..	13
Diphtheria	1(1)	..	..	1(1)	..	..	..	..	2
Dysentery (Bacillary)	..	1	1	..	..	..	2	..	4
Encephalitis	..	..	..	..	..	..	..	..	..
Filariasis	..	..	..	..	..	..	..	..	..
Homologous Serum Jaundice	..	..	..	..	..	..	..	..	..
Hydatid	..	1(1)	..	..	..	..	..	..	1
Infective Hepatitis	58(36)	8(4)	..	1	3(2)	3	1	..	74
Lead Poisoning	..	..	1	..	..	..	..	..	1
Leprosy	..	..	..	..	..	..	..	..	..
Leptospirosis	..	..	..	..	..	..	..	..	..
Malaria	..	..	..	..	..	..	..	..	..
Meningococcal Infection	1(1)	4(4)	..	1	..	..	..	..	6
Ophthalmia	..	..	..	..	..	..	..	..	..
Ornithosis	..	..	..	..	..	..	..	..	..
Paratyphoid	..	..	..	..	..	..	..	..	..
Plague	..	..	..	..	..	..	..	..	..
Poliomyelitis	1	1	..	..	..	..	..	..	1
Puerperal Fever	..	..	1	1(1)	..	..	..	..	2
Rubella	..	46(33)	29(18)	43(15)	22(21)	..	1	2	143
Salmonella Infection	..	..	..	..	..	..	..	..	..
Scarlet Fever	12(6)	12(10)	..	3(1)	1(1)	..	..	..	28
Smallpox	..	..	..	..	..	..	..	..	..
Tetanus	..	..	1(1)	..	..	..	..	..	1
Trachoma	..	..	..	..	2	..	3	..	5
Trichinosis	..	..	..	..	..	..	..	..	..
Tuberculosis	41(20)	11(7)	6(3)	3(1)	9(6)	3	..	..	73
Typhoid Fever	..	..	..	..	..	..	..	..	..
Typhus (Flea-, Mite- and Tick-borne)	..	..	2	..	..	..	..	..	2
Typhus (Louse-borne)	..	..	..	..	..	..	..	..	..
Yellow Fever	..	..	..	..	..	..	..	..	..

[1] Figures in parentheses are those for the metropolitan area.

Martin Desmond Begley and Archibald McLaren Millar are transferred to the Retired List, dated 30th June, 1957, 28th June, 1957, and 31st July, 1957, respectively.

AUSTRALIAN MILITARY FORCES.

Citizen Military Forces.

Northern Command.

Royal Australian Army Medical Corps (Medical).—The provisional rank of 1/25222 Captain B. Bruce-Smith is confirmed.

Eastern Command.

Royal Australian Army Medical Corps (Medical).—The provisional appointments of the following officers are terminated: Captains 2/147954 H. J. Keogh, 23rd May, 1957, and 2/130116 M. X. Shanahan, 3rd July, 1957. To be Captains (provisionally): 2/147954 Herbert John Keogh, 24th May, 1957, 2/130116 Mark Xavier Shanahan, 4th July, 1957, and 2/104469 Peter Maxwell Mulvey, 29th August, 1957.

Southern Command.

Royal Australian Army Medical Corps (Medical).—5/44300 Captain P. D. Breidahl is transferred to the Reserve of Officers (Royal Australian Army Medical Corps (Medical)) (Southern Command), 16th July, 1957.

Central Command.

Royal Australian Army Medical Corps (Medical).—4/32004 Captain D. D. Beard ceases to be seconded whilst in the United Kingdom, 23rd August, 1957.

Tasmania Command.

Royal Australian Army Medical Corps (Medical).—The notification respecting 6/15421 Captain (provisionally) K. S. Goulston which appeared in Executive Minute No. 134, of 1956, promulgated in Commonwealth Gazette No. 71, of 1956, is withdrawn.

Reserve Citizen Military Forces.

Royal Australian Army Medical Corps (Medical).

Eastern Command.—The resignation of Captain K. W. Bretherton of his commission is accepted, 21st August, 1957.

Southern Command.—To be Honorary Captains: Kevin Francis King, 20th July, 1957, and Peter Francis Hart, 30th July, 1957.

Western Command.—The following officers are placed upon the Retired List (Western Command) with permission to retain their rank and wear the prescribed uniform, 30th September, 1957: Major (Honorary Lieutenant-Colonel) B. W. Nairn, M.B.E., and Captain M. Starke.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE following additions and amendments have been made to the Register of Medical Practitioners for New South Wales in accordance with the *Medical Practitioners Act*, 1938-1957:

Registered medical practitioners who have complied with the requirements of Section 17 (3) and are registered under Section 17 (1) (*a*) of the Act: Shine, Francis William, M.B., B.S., 1953 (Univ. Melbourne).

Registered medical practitioners who have complied with the requirements of Section 17 (3) and are registered under Section 17 (1) (*b*) of the Act: Belton, Arthur Austin, M.B., Ch.B., 1949 (Univ. Sheffield), F.R.C.S. (England), 1954; Carn, Gerald, L.R.C.P., L.R.C.S. (Edinburgh), L.R.F.P. & S. (Glasgow), 1928; Gibb, Ann Florence, M.B., Ch.B., 1934 (Univ. Edinburgh); Holloway, Harold John, M.B., Ch.B., 1941 (Univ. Birmingham); Hurrell, Frederick Charles, M.B., B.S., 1952 (Univ. London), M.R.C.S. (England), L.R.C.P. (London), 1952; Manson, Charles Noel Sinclair, M.R.C.S. (England), L.R.C.P. (London), 1941; Merryfield, Stephen James Thomas, M.R.C.S. (England), L.R.C.P. (London), 1942; Oliva, Rudolph Charles, M.R.C.S. (England), L.R.C.P. (London), 1953, D.A. (England), 1957; Rayner, Henry James, M.B., B.S., 1953 (Univ. London).

Registered medical pactitioners who have had licences issued under Section 21c of the Act: Abrahamowski, Zeno, M.D., 1939 (Univ. Vienna), issued September 9, 1957, in respect of Lithgow District Hospital; Lin, Michael Fen Chong, M.D., 1952 (Univ. Lignan, Canton), issued September 11, 1957, in respect of Bulli District Hospital; Natasien, Vladimir, M.D., 1924 (Univ. Charkov), issued September 26, 1957, in respect of Base Hospital, Dubbo.

Deaths.

THE following deaths have been announced:

ANDREWS.—Julian Andrews, on October 25, 1957, at Adelaide.

PELLEW.—Leonard James Pellew, on November 3, 1957, at Adelaide.

BYRNE.—Ethel Byrne, on November 5, 1957, at Newcastle, New South Wales.

Diary for the Month.

Nov. 26.—New South Wales Branch, B.M.A.: Ethics Committee.
Nov. 27.—Victorian Branch, B.M.A.: Branch Council.
Nov. 30.—New South Wales Branch, B.M.A.: Country Branch Meeting at Katoomba.
Dec. 3.—New South Wales Branch, B.M.A.: Organization and Science Committee.
Dec. 4.—Victorian Branch, B.M.A.: Branch Meeting.
Dec. 4.—Victorian Branch, B.M.A.: Branch Council.
Dec. 4.—Western Australian Branch, B.M.A.: Branch Council.
Dec. 5.—New South Wales Branch, B.M.A.: Clinical Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales. Anti-Tuberculosis Association of New South Wales.

Queensland Branch (Honorary Secretary, 88 L'Estrange Terrace, Kelvin Grove, Brisbane, W.1): All applicants for Queensland State Government Insurance Office positions are advised to communicate with the Honorary Secretary of the Branch before accepting posts.

South Australian Branch (Honorary Secretary, 80 Brougham Place, North Adelaide): All contract practice appointments in South Australia.

Editorial Notices.

ALL articles submitted for publication in this Journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given: surname of author, initials of author, year, full title of article, name of journal, volume, number of first page of the article. The abbreviations used for the titles of journals are those adopted by the Quarterly Cumulative Index Medicus. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary is stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2-3.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this Journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

SUBSCRIPTION RATES.—Medical students and others not receiving THE MEDICAL JOURNAL OF AUSTRALIA in virtue of membership of the Branches of the British Medical Association in Australia can become subscribers to the Journal by applying to the Manager or through the usual agents and booksellers. Subscriptions can commence at the beginning of any quarter and are renewable on December 31. The rate is £5 *per annum* within Australia and the British Commonwealth of Nations, and £6 *per annum* within America and foreign countries, payable in advance.